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MARCH 3, 1961

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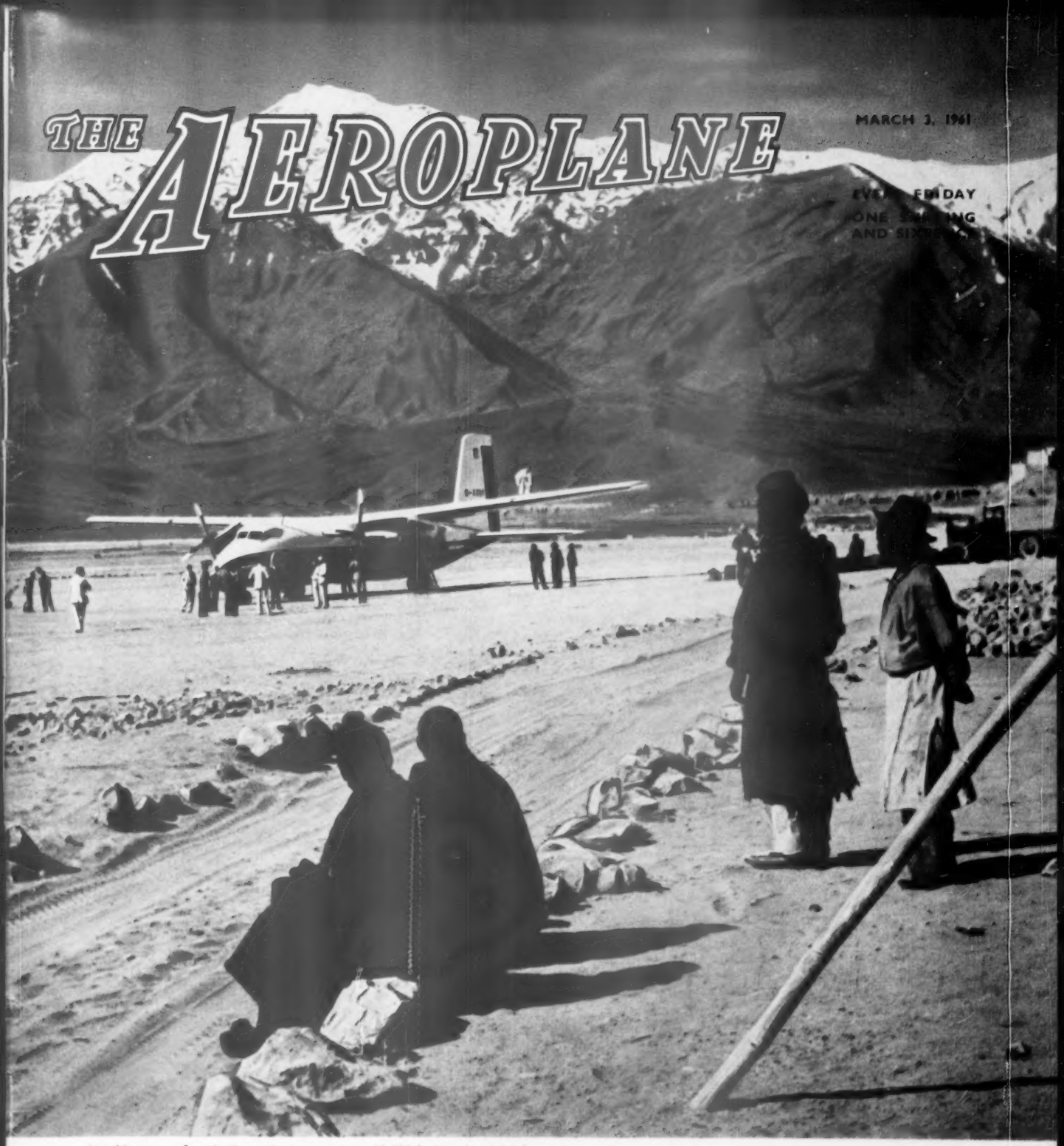

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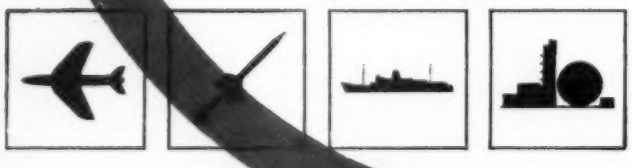

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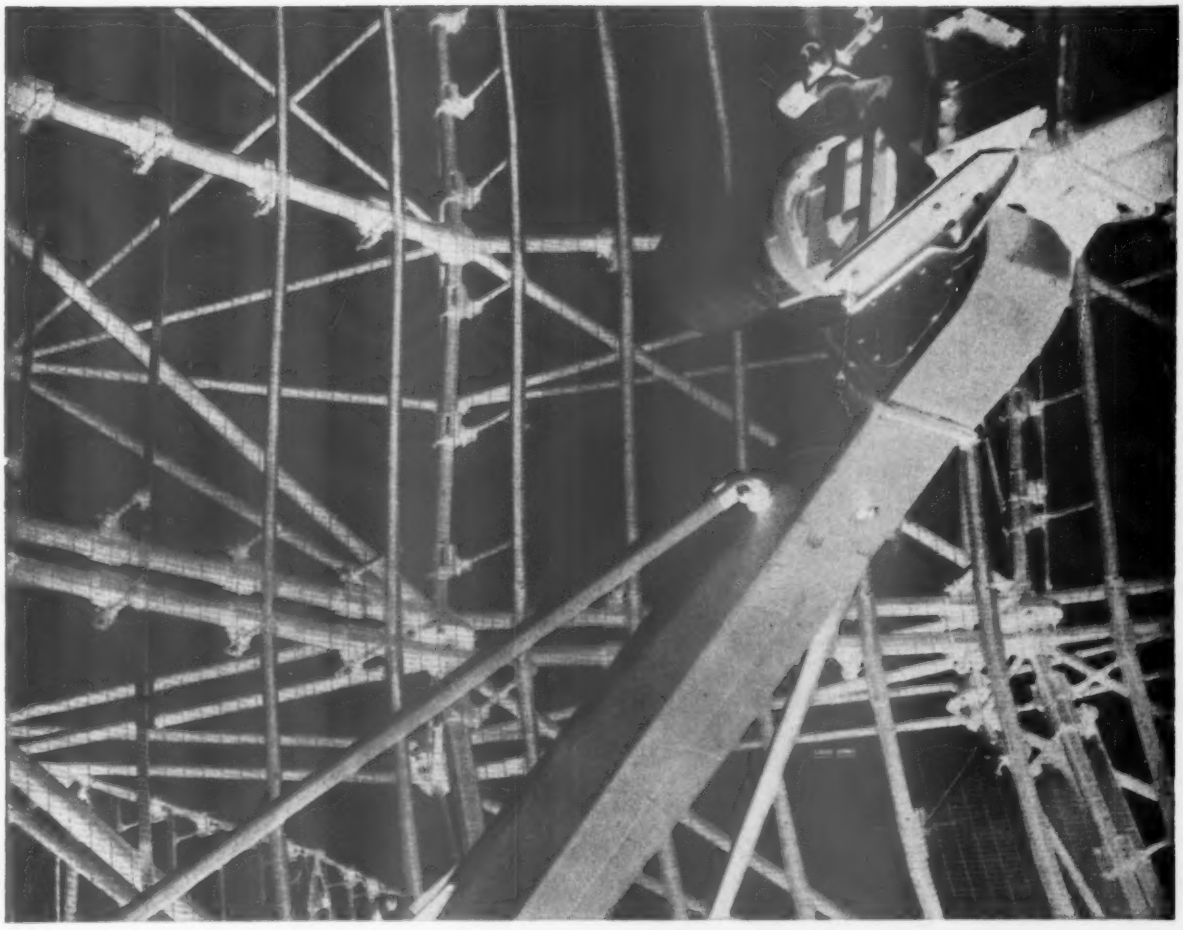

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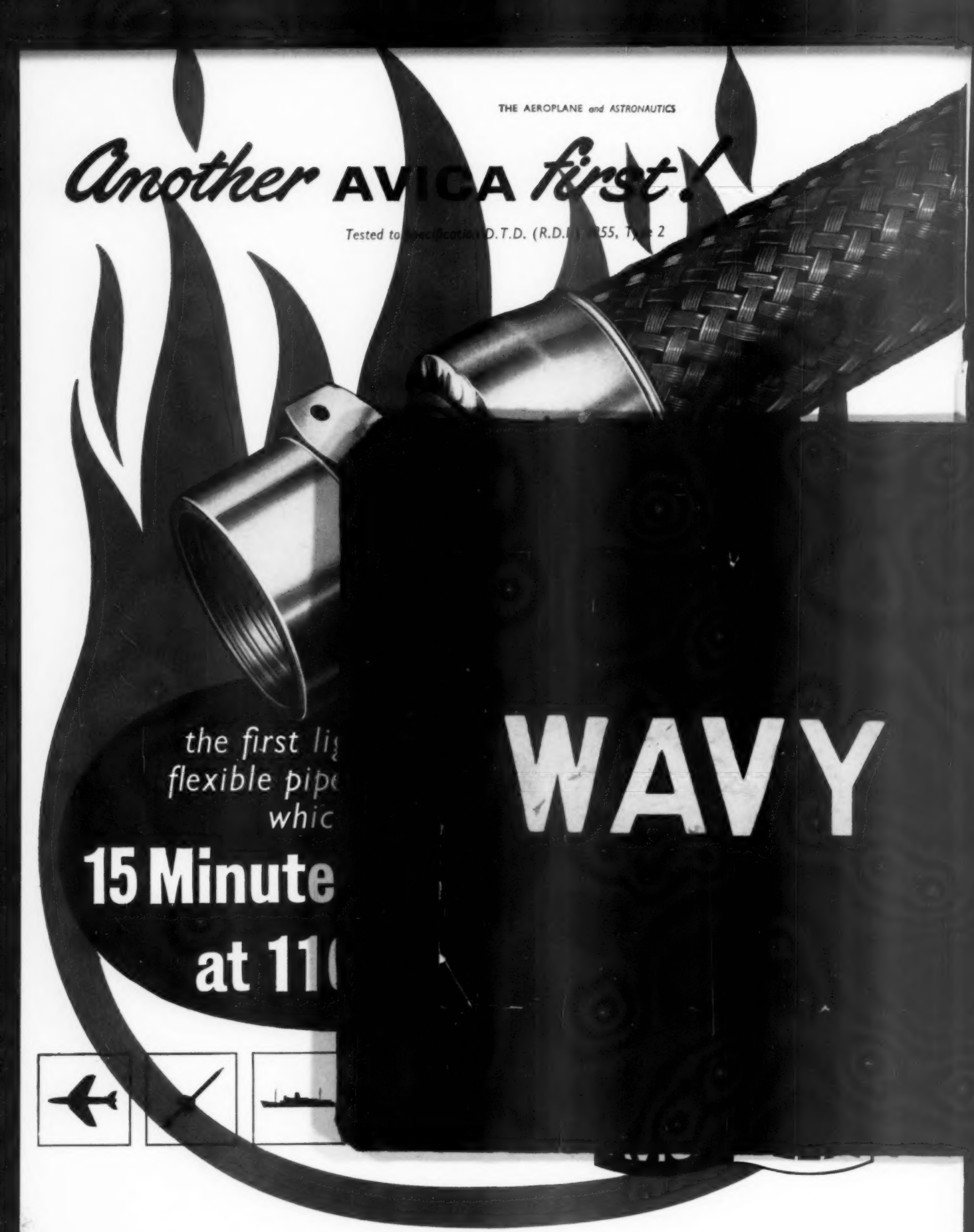

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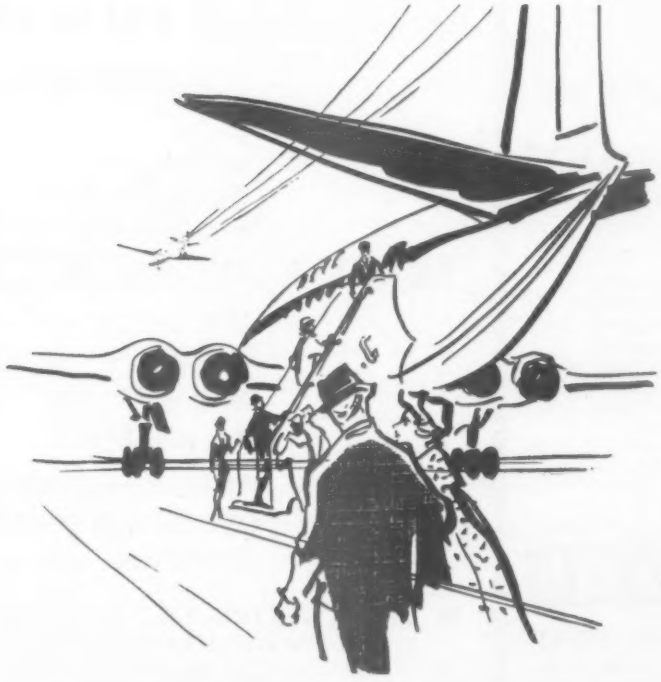

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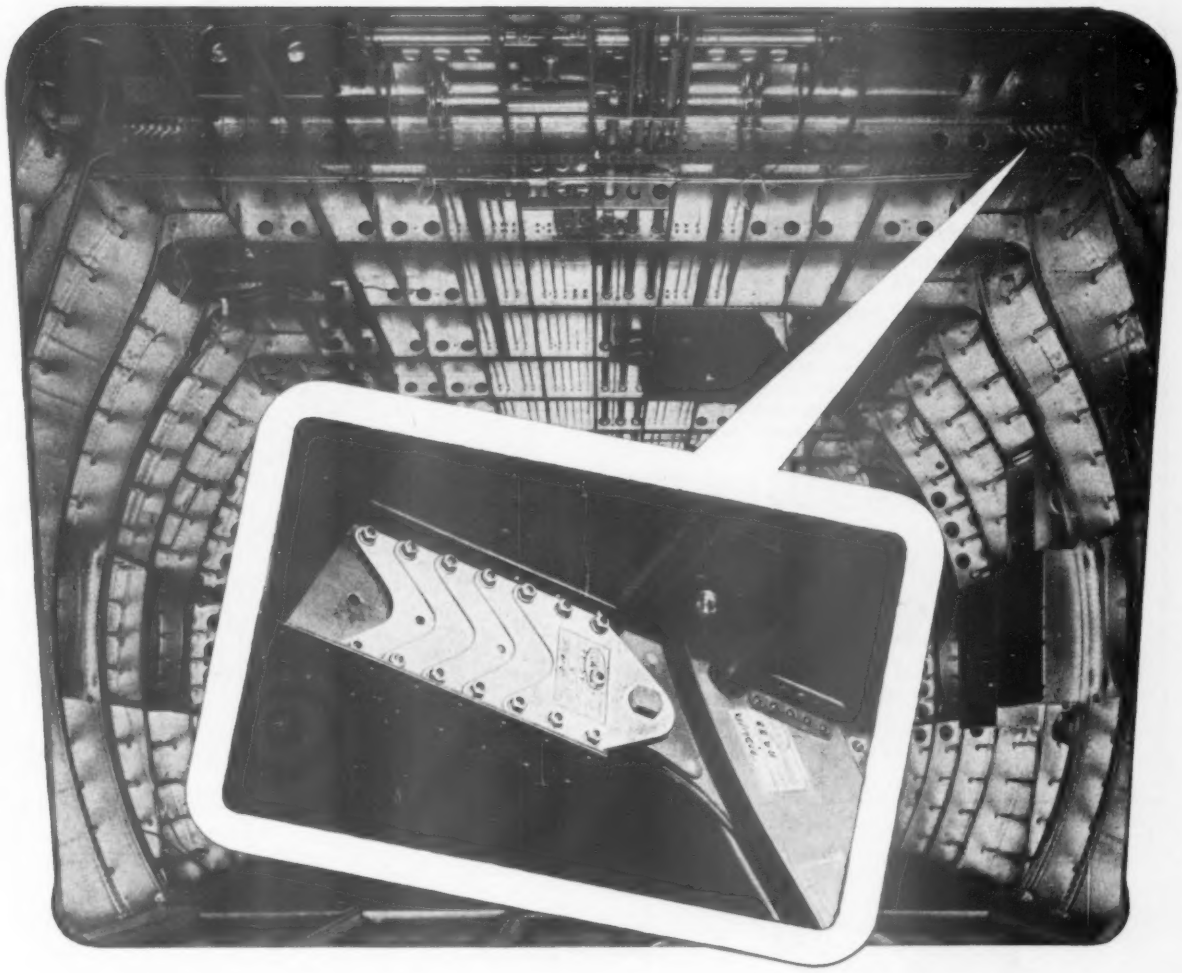

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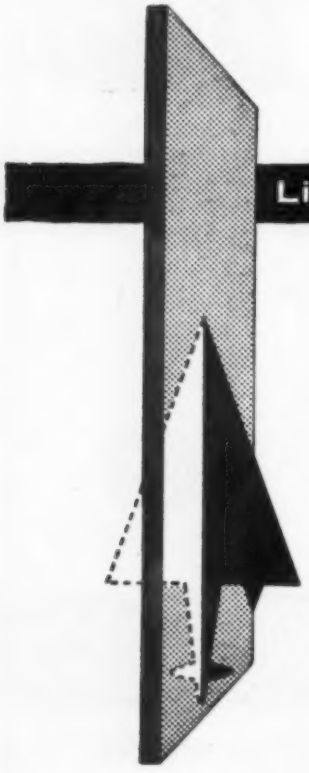

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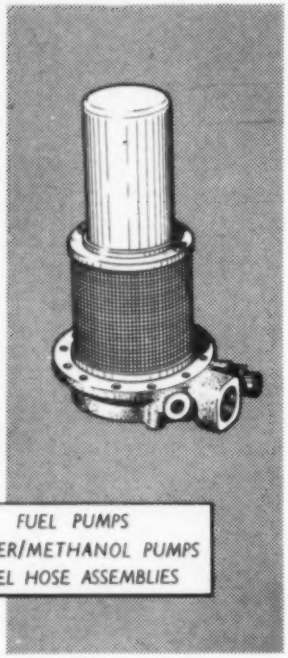

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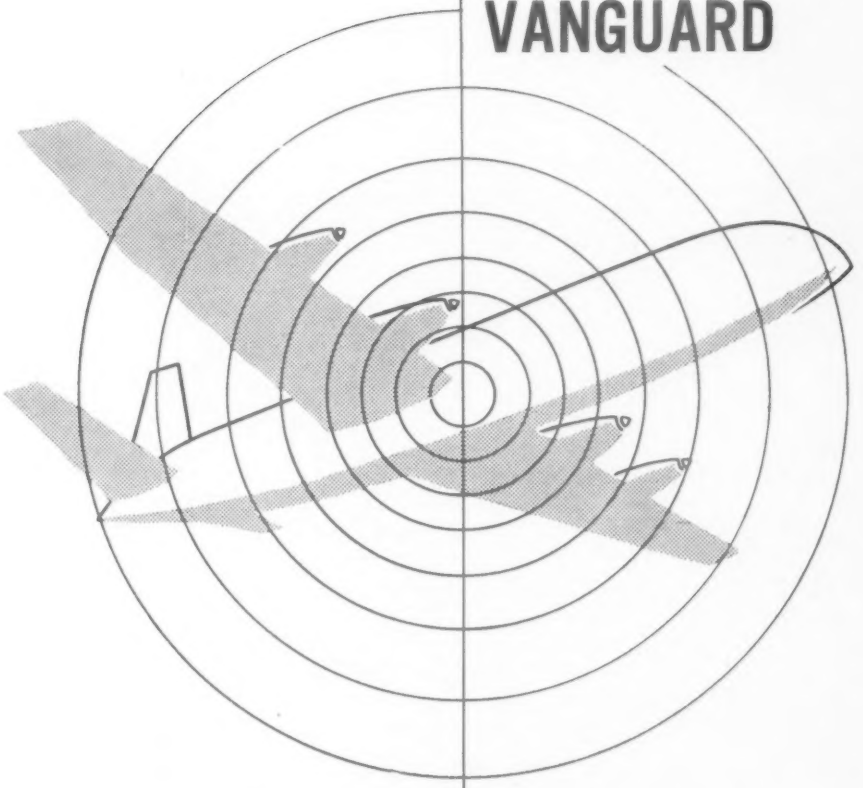

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THE AEROPLANE and ASTRONAUTICS

VOLUME 100 NUMBER 2576 MARCH 3, 1961

Helicopters—Last Chance?

Two recent pronouncements seem to indicate that a wind, if not of change, at least of activity, is blowing across the arid fields of helicopter development in British civil aviation. After making an historic beginning with its scheduled helicopter operation B.E.A. dropped out of the running, seemingly content to keep its eye in with research and development. However, Mr. Anthony Milward, chief executive of B.E.A., on returning recently from the United States, has let it be widely known how much impressed he is with the go-ahead activities of the three chief operators of scheduled helicopter services in the United States. B.E.A. has, however, yet to make known its own plans. It seems clear that the first practical step would be the linking of the major metropolitan airfields.

The most promising line of attack would be to push on with the Rotodyne, for in this aircraft we in this country still have a prototype which is years ahead of its nearest competitor. Consequently, Mr. Thorneycroft's recent disclosure that he is aiming to press on with development tests of the existing Rotodyne prototype is the best possible news. We have always felt that it would be a mistake to leapfrog the prototype design and start again on a bigger version with Tyne engines. This could only postpone the introduction into practical test of the aircraft which has the capability of linking London and Paris by journeys of shorter duration than any other vehicle at present available.

It is going to be a hard struggle to ensure that the capabilities of this unique vehicle are not lost to British aviation through too hasty a reaction to the problems of noise posed by the prototype. The operational advantages of the Rotodyne are so tremendous, a solution must be found.

Terms of Reference

Do our air specialists stick sufficiently closely to their subject? The query comes to mind this week as a result of the inauguration of the new airport at Orly. Air France have, or are about to, cut out all " processing " of passengers except at the airfield. The former "Aerogare " at Les Invalides is to become an information pavilion and bus terminus. The responsibility for getting to the airfield (either Orly or Le Bourget) is that of the passenger.

If a passenger wants to save time he or she can go by taxi or private car. If one wishes to save money one can go by coach from Les Invalides (which costs 300 francs). This seems a giant stride towards accepting the situation that an airline's responsibilities begin and end at the airport boundary. It is for surface transport specialists to ensure ground transport by road or rail.

In this country the responsibility is still accepted by the airline for processing its passengers in town. The farther one plans to travel, the nearer the heart of things one is processed. B.O.A.C. passengers are " done " in Victoria whereas those of B.E.A. are dealt with on the way to Earls Court. There is now talk of B.E.A. putting up £1 million towards the cost of a rail link.

Would the Corporation not do better to apply the money to the reduction of passenger fares and leave surface transport to expert operators in that field?

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Editorial, Advertisement and Publishing Offices:
BOWLING GREEN LANE, LONDON, E.C.1

Telephone: TERminus 3636
Telegrams: "Pressimus London Telex"
Telex: 23839

Annual Subscription Rate: United Kingdom £4 15 0
Overseas £5 Canada and U.S.A. $15.00

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Matters of Moment

Aerodromes Vital for Business Flying

AN urgent plea that one of the most important requirements in British aviation today is the creation of more aerodromes of all classes, both licensed and unlicensed, was made at the 1961 Dinner of the Aerodrome Owners Association in London on Feb. 23. Mr. Peter Masefield, who made it, went on to urge the Association to bring into its ranks not less than 100 owners of new aerodromes during the next five years. And heliports simply could not be used to "make do."

Mr. Masefield seems to have lost some of his enthusiasm for the helicopter. "The great growth of flying in the future," he said, "is going to be the fixed-wing aeroplane on the grounds of economy and noise."

After attacking the Ministry of Aviation for being out of touch with practical aviation, Mr. Masefield, defining the scope of British aviation as being much bigger than the bounds of any sectional interest, said: "The air belongs to all who use it—and we have to learn to live together."

Looking to the early achievement in this country of similar conditions to those obtaining in the United States where general aviation operates 26 times the number of aircraft and flies three times as many hours as all the scheduled and unscheduled airlines, Mr. Masefield spoke of the healthy growth of the British Business Aircraft Users Association which more than 75 companies have shown interest in joining. And in their number are practically every big organization in this country.

He gave special effort to the defining of a most important new philosophy of "free air space." This is the air below the base of controlled air space. He decried the imposition of Permanent IFR, the letters he said really stood for Permanent Isolation from Reality. "Let us have instead," he demanded, "limited 'Special Control Areas' in which instrument flight rules can apply but only above certain heights and in the vicinity of major airports." He wants free air space up to 2,000 ft. except within five miles of major airports.

Finally he proposed that the time is now ripe for the formation of a "Council of British Aviation Bodies" on which would be represented all the Associations and Societies which look after different aspects of the national aviation endeavour. Meeting twice a year, such a Council could ensure the co-ordination of major items of national aviation policy.

His speech to the toast "Civil Aviation" was replied to by Air Vice-Marshal Sir Laurence F. Sinclair, Controller of Ground Services, M.o.A. Earlier Col. C. F. H. Gough had proposed the "Association" to which Alderman F. H. O'Donnell, chairman of the A.O.A., had replied. Lord Lindgren of Welwyn Garden City replied for the guests, whose health had been proposed by Mr. Raymond Birkett.

SQUADRON STRENGTH.—Twelve English Electric Lightning F.Is of No. 74 "Tiger" Squadron (Sqn. Ldr. J. F. G. Howe) in dispersal at R.A.F. Coltishall. The conversion and the new operational rôle of the Squadron was described in our previous issue.

Photograph copyright "The Aeroplane and Astronautics"

Official Vanguard Inauguration

PUBLICATION of our issue last week coincided, more or less, with the official inauguration of the Vanguard services between London and Paris. In consequence there is no need here either to enlarge on the capabilities of Vickers' second-generation turboprop or to say much about B.E.A.'s intentions with their new 114-seat airbuses. The high cruising speed of the Vanguard (380 m.p.h.) does make possible a reduction in the journey time.

Improvements are planned in passenger-processing procedures as will be seen from our report on the opening of the new French airport at Orly. We wish we could report that improved surface transport is going to augment these time savings. At present we fear the reverse.

The inaugural trip began with customary ceremony on Feb. 22 when Rear Admiral Grant presented Lord Douglas of Kirtleside, chairman of B.E.A., with a replica of the badge of the battleship H.M.S. "Vanguard." The teak mounting had been taken from the broken-up battleship's deck and in true aircraft tradition the badge itself was a light alloy casting. The ceremony took place at the apex of a Vee formed by B.E.A. stewardesses in their neat dark blue braid-edged uniforms. The Honourable Katharine Douglas was an enthusiastic, if not entirely comprehending, participator in the proceedings.

In Paris the whole party, which included Mr. Peter Thorneycroft, Minister of Aviation, and Mrs. Thorneycroft, were entertained by Sir Pierson Dixon and Lady Dixon to a buffet lunch at the Embassy. Afterwards there was a ceremony at the Hôtel de Ville when M. Julien Tardieu, president of the municipal council, exchanged courtesies with Mr. Thorneycroft.

Functions such as this are always pleasant to attend even if the more successful the service they inaugurate, the nearer the time that the ceremonies will lose their sense.—T.J.

Aero-electronics in Greece

RESPONSIBILITY for the operation and management of the Greek National Calibration and Testing Laboratory—organized by the Greek armed forces with the co-operation and assistance of the Joint U.S. Military Advisory Group to Greece—will lie with the Royal Hellenic Air Force. The Laboratory, which will be mainly concerned with the control, calibration and testing of the electronics equipment used by the Greek armed forces, is established at Hellenikon Airport (Athens). It will operate as a sub-unit of the State Aircraft Factory which is now administered by the R.H.A.F. under the direct command of the Hellenic General National Defence Staff.

At the recent opening ceremony, the speakers included

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"TIGER" TEETH.—Groundcrew arming a No. 74 Squadron Lightning with its two D.H. Firestreak air-to-air missiles. Unlike the interceptor's two 30-mm. Aden guns, these have yet to be fired by the Tigers.

Maj.-Gen. H. J. Van der Heide, U.S. Army, Chief of JUSMAAG, who stressed the importance of the fact that Greece is the only country in the Near and Middle East possessing such a laboratory. Gp. Capt. N. Papademetriou, R.H.A.F., Chairman of the Board, explained the scope of the laboratory and the possibilities of its utilization for military and non-military measurement purposes and also for industrial and pure scientific research.

Gp. Capt. K. Houlis, R.H.A.F. Director of the State Aircraft Factory and Flt. Lt. Makris, R.H.A.F., have been appointed general director and technical director of the Laboratory, respectively.—T.C.T.-T.

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VANGUARD INAUGURAL.—Rear Admiral Grant speaking on Feb. 22 before presenting the replica of H.M.S. "Vanguard's" badge to Lord Douglas. The Honourable Katharine Douglas, representing the ladies on the trip, is regarded benignly by Mr. Thorneycroft, Minister of Aviation.

The Beagles Are Coming

HIGHLIGHT of this year's Shackleton Aviation Weekend at Baginton, Coventry, Apr. 28-30, will undoubtedly be the first public appearance of two new models from the Beagle-Auster organization. As the first products of the new British light aircraft consortium, these are likely to compare more than favourably with competitive foreign types on price and performance, as well as in conception and comfort. With the two new Beagle-Austers will be presented an improved version of the low-cost Tugmaster, developed from the military Auster 6.

Other British exhibits for executive use will be the D.H. Dove Mk. 8 and the D.H. Heron, together with the Beagle-Miles Student. French light aircraft shown by Rollason Aircraft and Engines, Ltd., will include the Jodel D.R. 1050 Ambassadeur and the Jodel D.140 Mousquetaire, as well as the well-known anglicized Turbulent, now with coupé canopy, spats and radio. From Belgium is another ultra-light, the single-seat Tipsy Nipper.

Germany will contribute the Dornier Do 27 and Do 28, which with the Klemm Kl 107C and the Bölkow F.207, will be making their initial U.K. appearance. Baginton will be the European début for the Lockheed-Azcarate LASA 60 utility aircraft, while other American newcomers, shown alongside the full range of more familiar types, will include the Piper Pawnee and Cherokee, the Beech Queen Air and perhaps the Baron, and the Grumman Gulfstream. A turboprop executive companion for the Gulfstream will be the Fokker Friendship.

Such additions as the Aeromere Falco and the Piaggio P.166 from Italy, and the Meta-Sokol, Aero 145, Morava L.200A and Zlin Trener from Czechoslovakia will help to ensure that the Baginton meeting will be the largest light aircraft show ever seen in the U.K. The airfield is to be open to the public from 11.00-18.00 hrs. each day, and special enclosures will be available for spectators, price 2s. 6d. for adults and 1s. for children.

An airfield lapel badge may be purchased for an additional 10s., to facilitate closer inspection of the aircraft. Visitors arriving by air will be admitted free of charge.

In addition to the static display of new and used aircraft and individual flights to potential customers throughout the day, there will be joy-riding and a special period of demonstration flying each afternoon from 15.00-16.00 hr.

Matters of Moment . . . .

Business Aircraft Appointments

TOP-LEVEL appointments to the design side of the Beagle Group were announced last week. Two are executive and two are consultative.

Mr. Marcus Langley, F.R.Ae.S., M.I.Mech.E., has been appointed technical director of Beagle-Auster Aircraft, Ltd. Mr. Langley, who remains a director of Tiltman Langley, Ltd., was appointed consulting engineer to the Beagle Group last year.

Mr. T. D. R. Carroll becomes deputy chief designer of British Executive and General Aviation, Ltd. Before joining Beagle Mr. Carroll was deputy design manager with Bristol Aircraft, Ltd.; he was responsible for all Canadian and American design variations of Britannias.

Prof. A. D. Young, M.A., F.R.Ae.S., A.F.I.A.S., has been appointed consultant in aerodynamics to the Group. He is Professor of Aeronautical Engineering at Queen Mary College, University of London.

Its consultant in industrial design is to be Prof. Misha Black, O.B.E., R.D.I., P.P.S.I.A., who has already started work on Beagle aircraft. He is a senior partner of Design Research Unit, which was responsible for interior designs on the new liner "Oriana." He is Britain's first professor of Industrial Design at the Royal College of Arts in London and president of the International Council of Societies of Industrial Designs.

Test Pilots' Friend Retires

AT Dunsfold Airfield recently, past and present Hawker test pilots, including George Bulman, Philip Lucas and Bill Bedford, joined a large gathering of senior executives and working associates to mark the retirement of Bill Turner, M.B.E., Hawker's assistant experimental supervisor, the man largely responsible, over some 38 years, for the serviceability and airworthiness of their experimental test aircraft.

He started with the British Caudron Co. in 1913 and except for two years with the Levis motor-cycle people, has been in aviation ever since. Hawker Engineering, as they were then, took him on in 1922 when he worked on the Duiker, a high-wing monoplane with long oleo-legs which kept letting it down—literally. Since then he has worked on every experimental Hawker aircraft, right up to the revolutionary P.1127.—WREN.

"THE MAESTRO"

Para-Visual for K.L.M.

ONE of K.L.M.'s DC-8s is to be fitted within the next fortnight with Smiths Para-Visual Director displays in both pilots' positions. The system will initially be used experimentally for an evaluation of the prospects of reducing weather minima under manual control and a three-day period of crew training has already been scheduled for this month.

This decision by K.L.M. followed the demonstrations with Smiths PVD-equipped Dove during the IATA Technical Conference last May when the system was first announced. Recently a K.L.M. party visited the U.K. to obtain more experience with the Dove and to take part in demonstrations, at the R.A.E. Bedford, with the PVD-equipped autoland Varsity operated by Smiths. These demonstrations included automatic approaches to low limits followed by manual reversion, using the PVD guidance for flare-out and touchdown; several successful manual flares to touchdown were made by K.L.M. pilots with the windscreen of the Varsity blacked out.

The DC-8—which will be the first commercial airline to be PVD equipped—will have its two three-unit displays fed from the existing flight system and will use director-computed ILS signals with an amplifier to power the displays, which, with the amplifier and the pilot's controller, will be supplied by Smiths and installed by K.L.M. at Schiphol.

Similar Para-Visual installations will be completed later in a B.O.A.C. 707, in an S.A.S. DC-8 and in a 707 by the Boeing Airplane Company. B.E.A. has specified PVD displays as a part of the Smiths automatic flight control and instrumentation system for the D.H.121 Trident.

BEAGLEMEN.—Mr. T. D. R. Carroll and Mr. Marcus Langley.

High-energy Rockets

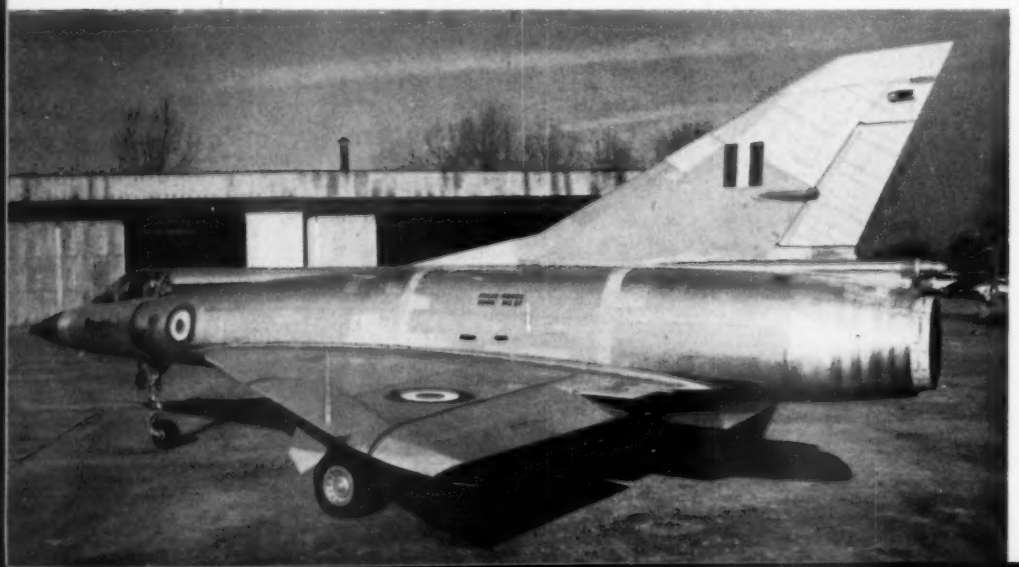
NEWS that liquid hydrogen has been considered as a possible fuel for the top stage of a later-day European satellite launcher employing Blue Streak and a French second-stage vehicle of some 55,000 lb. s.t., has placed increased interest on the symposium which the British Interplanetary Society is holding on "Liquid Hydrogen as a Rocket Propellent." The meeting will be held on Friday, Apr. 28, in the Lecture Hall of the Royal Aeronautical Society, 4 Hamilton Place, London, W.1. Registration forms are obtainable from the Secretary, British Interplanetary Society, 12 Bessborough Gardens, London, S.W.1.

The programme will include the following papers:—

"Liquid Hydrogen Production on an Industrial Scale," by T. J. Webster (Manager, Gas Separation Dept., Scientific Division, The British Oxygen Co., Ltd.); "Production, Storage and Handling of LH_2," by W. Scharle (Process Manager, Air Products (Gt. Britain), Ltd.); "The Use of Liquid Hydrogen in Large-scale Rockets," by A. V. Cleaver (Chief Engineer, Rocket Propulsion, Rolls-Royce, Ltd.).

"Design of Rocket Engines Burning Liquid Hydrogen as Fuel," by D. Hurden (Research Manager, The de Havilland Engine Co., Ltd.); "The Use of Liquid Hydrogen in the Third Stage of a Satellite Vehicle," by Dr. B. W. A. Rickerson and R. G. Cruddace (Rocket Propulsion Establishment, Westcott); "Optimum Engine and Vehicle Coupling for Satellite Launching Stages using Liquid Hydrogen," by M. S. S. Hunt, G. W. Brown and B. G. White (Rocket Department, Bristol-Siddeley Engines, Ltd.).

"Liquid Hydrogen Behaviour in Space," by K. R. Stehling (Office of Program Planning and Evaluation, NASA); "Liquid Hydrogen as a Working Fluid in Advanced Propulsion Systems," by P. A. E. Stewart (Advanced Projects Division, Hawker-Siddeley Aviation, Ltd.); and "The Use of Hydrogen in Nuclear Rockets," by O. H. Wyatt (Senior Project Engineer, Hawker-Siddeley Nuclear Power Co., Ltd.).



ROLLS-POWERED.—First photograph of the Dassault Mirage IIIO, powered by the 12,500 lb. (dry) thrust Rolls-Royce Avon Mk.67 (R.B.146), which is to be evaluated by the R.A.A.F. against the Atar-powered Mirage IIIC. The Mirage IIIO made its first flight on Feb. 13 and has already demonstrated its improved performance by flying well above M=2.

Aerospace—A Franco-British Approach

A WORKING basis for the future of aerospace development in Europe has been established by the alliance announced this week, of the Hawker Siddeley Group and the French aviation and missile consortium, SEREB. A feasibility study, jointly prepared by the two organizations, was published simultaneously in London and Paris on Feb. 28.

This comprehensive document lists three main projects for consideration by the respective governments: (1) Civil communications satellites; (2) Civil navigation satellites, and (3) Military anti-satellite missiles.

The study discloses that Hawker Siddeley and SEREB have been working together for many months as a Franco-British Initiative Group for the purpose of analysing the aerospace potential in Europe.

Hawker Siddeley Aviation controls seven British aviation and missile companies, the largest single group in the Commonwealth. Within its organization are development and production facilities for the Blue Streak which, if the project for a European heavy satellite launcher materializes, would form the first stage.

SEREB (Société pour l'Etude et la Réalisation d'Engins Ballistiques) represents an association of the most powerful aircraft and missile interests in France and is controlled by the French Government. This organization is concerned with the development of the French I.R.B.M. and would be responsible for Blue Streak's second stage in the rôle of satellite launcher.

Thus the basis exists for a sound working relationship on a big European rocket with all the extensive research and development facilities that such a project would involve. And although the Initiative Group has been founded on Franco-British collaboration, the door has been left open for aerospace industries in other countries.

Nevertheless, Sir Roy Dobson, managing director of the Hawker Siddeley Group, has made it clear that the industrial study is not tied to any particular type of launcher, but rather is concerned with placing various civil and military space projects in their proper perspective as economic realities for Europe. "This joint evaluation, industry to industry," he said, "is an essential first step to any government-sponsored aerospace programme involving Europe and the Commonwealth.

"It should be clear to all concerned that these feasibility studies open the way for a tremendously exciting and rewarding new era. The studies have already been submitted to both the British and French Governments."

Those playing a leading part in the Hawker Siddeley aerospace team are: Mr. Stuart D. Davies, technical director, Hawker Siddeley Aviation; Mr. James C. Floyd, chief engineer, Advanced Projects Group, Hawker Siddeley Aviation; Mr. Michael N. Golovine, managing director, A.T.S. Co., Ltd.; Dr. W. F. Hilton, head of the Astronautics Section, Advanced Projects Group, Hawker Siddeley Aviation; and Mr. H. R. Watson, aerospace director, Sir W. G. Armstrong Whitworth Aircraft, Ltd.

The French SEREB Company was set up by the French Government in 1959 to act as systems managers for all ballistic weapon development to be undertaken in France or in association with other countries. Shares in the company are held by: Nord-Aviation; Sud-Aviation; SNFCMA; Office National D'Etudes et de Recherches Aéronautiques; Générale Aéronautique Marcel Dassault; MATRA; and SEPR.

Communications Satellites

There are two distinct proposals for communications satellites. The first presents the case for a station-keeping and stabilized satellite and represents an extension of the Hawker Siddeley design study published last year. The transmitter incorporates a travelling-wave tube operating at a frequency of about 2,000 Mc/s. This choice entails fairly high power requirements but simplifies the frequency allocation problem.

The second proposal is designed around a transmitter using a triode valve (or transistors, if possible) and operating at lower frequencies, around 500 Mc/s. There is no mechanical stabilization of the satellite, but one of the versions incorporates "electronic stabilization" by antenna selection. The main feature is a reduction in weight per satellite, although a greater number of satellites may be necessary. This work is French.

Clearly, the basic requirement of a satellite communications system is to provide a service as good as, if not better than, the present cable system at a cost that will ultimately be highly competitive. For the cost of a suitable receiving aerial, communications can be opened up between areas that otherwise have, and will continue to have, no possibility of a communications system. The reception must be of good quality and would have to meet the relevant CCIR* international proposals.

It is obviously necessary, the Report continues, that the satellites must operate at a height which will permit reasonable communication times between the various areas, without incurring expensive power requirements. There is, of course, no substitute for height however many satellites are available. A stabilized satellite on account of its higher radio power capabilities can operate at heights from 4,000 to 10,000 miles and provide a good coverage. Above 10,000 miles, apart from the higher power required, the time lag of the signal becomes significant. For the 24-hr. orbit, for example, it amounts to ¼ sec, which is well above international recommendation.

It is also of considerable advantage for the satellite system to provide a 24-hr. service whenever possible. This requires a system of satellites, suitably disposed, with a facility to switch from the setting satellite to the rising one as required.

Satellite Navigation

Under the heading of navigational satellites, the document stresses the importance of keeping abreast of the latest satellite techniques for providing an accurate fix for surface and air transportation. If the co-ordinates of a satellite are known to the surface vehicle or aircraft at the moment of fix, the satellite can provide an excellent bearing.

Astronomical tables can be prepared as soon as the satellite has been injected into orbit but, because of a number of causes, either only partly known or unpredictable, regular ground tracking would be required to obtain revised orbital parameters. Two methods which might be contemplated are (1) direct retransmission by "earth channel," or (2) use of the satellite itself as a relay.

From the study, it emerges that the requirements for coverage and accuracy could be met either by six satellites of about 55 lb. weight rotating in orbits of small eccentricity and with a perigee of 300 miles, or by four satellites of the same weight orbiting with a perigee of over 500 miles.

Satellites of the first type could be launched with the help of a three-stage carrier, having a take-off mass of about 17 tons. The three stages would employ present day technology and would thus be fairly easy to design. The first stage could have liquid propulsion, with a motor of about 25 tons thrust. The other two stages could be solid, with a fairly advanced manufacturing technique for the last stage. The same carrier, in a slightly improved version (time delay about a year) could launch the second category of satellite (perigee 550 miles).

An anti-satellite weapon

As regards the Anti-Satellite system, the problem of countering a satellite in orbit is one which presents special difficulties. The high speed of the target and the difficulty of damaging it in the environment of space restrict considerably the choice of possible counter measures. In addition, the target may assume a variety of forms, since many different missions can be regarded as offensive, for example, reconnaissance and communications as well as bombardment.

A target, the report adds, may be considered to have been effectively countered when it has been rendered incapable of performing any hostile act directly or indirectly. On such a basis, it may not be necessary physically to destroy the satellite, but in some circumstances at least it would be sufficient merely to destroy a vital component or to prevent from occurring some essential sequence of events, such as arming.

Four principal methods of target destruction are outlined: (1) to project various materials into the path of the satellite to erode or obliterate either the vehicle or parts of it directly associated with its hostile missions; (2) to eject projectiles that would damage the vehicle by impact; (3) to emit harmful electromagnetic or particle radiation and (4) to establish electric or magnetic fields around the vehicle in order to affect its contents.

Although no attempt has been made to design an anti-satellite missile but only to demonstrate its feasibility, it is clear that much detailed thought lies behind the written presentation. Accuracy of rendezvous is, of course, the main problem in the design of such a weapon system. However, it is not considered necessary for the missile to enter the same orbit as the target satellite, but only to get to about the same position at the same time.

An example is given of an anti-satellite missile with an explosive warhead. The last part of the survey includes an estimate of the minimum payload that it will be necessary to get to the vicinity of the target satellite. This payload must include the bomb itself, fusing mechanism, terminal guidance, and ancillary equipment. Warhead and fusing mechanism

* CCIR = The Consultative Committee on International Radio, an agency of the International Telecommunication Union.

Matters of Moment . . . .

appear to demand at least 600 lb. or, for a multi-megaton explosive yield, anything up to as much as 10 times this. A total of 1,250 lb. is assumed for a two-megaton bomb.

It is envisaged that some form of corrective propulsion will be required, although it probably need not exceed about 500 ft./sec. total velocity increment. An allowance of about 7% of the payload weight has been made for this.

Details of the control and guidance system have not been determined. It is unlikely, however, that a combination of command plus active or semi-active guidance would weigh more than 200 lb. Command guidance can be used since the missile may be assumed not to be over enemy territory at the time of interception, so that there will be little chance of the radio command being jammed. Use of command guidance would obviate the need for a heavy complex pure-inertial guidance system.

Therefore, the total payload will probably be about 1,700 lb. The launch mass would obviously depend on the launching method and might be anything from 10,000 to 100,000 lb. Since the desirability of achieving short flight times is important, preliminary calculations have been based on high thrust/weight ratios. Even for a thrust/weight ratio as low as five at launch, the dynamic pressures on, and kinetic heating of, ground-launched vehicles are larger than is desirable. Air-launching from a few miles above the Earth's surface (altitudes above 50,000 ft., a reasonable maximum for heavily laden aircraft) has been found to reduce the peak dynamic pressures experienced to acceptable values.

The other advantages of air-launching are shared to a lesser degree with the other types of mobile launching (i.e. ships, submarines, trains and road vehicles). The aeroplane, however, is faster and is unaffected by the nature of the surface below it. Any mobile launcher is harder for the enemy to eliminate than a static site, and it also allows the missile to be launched from a point in the orbital plane of the satellite. This is important not only because the missile can then use the economical vertical ascent path, but also because only then is the best advantage taken of the low speed of the missile and its long period of time at orbital altitude.

Thus, in the light of these considerations and the fact that a satellite does not constitute a threat unless it passes nearly overhead, a missile having a single main stage plus booster might weigh about 28,000 lb. at take-off. The structure/mass ratio of both main stage and booster would be about 10 and the specific impulse 250 sec., employing solid propellents. The payload, including corrective propulsion unit, would be 1,700 lb. which should be sufficient to contain a two-megaton bomb, while the guidance system should take the bomb within a maximum of three miles to the target. Booster thrust would be about 140,000 lb. for 25 sec. and sustainer thrust, say, 60,000 lb.

A missile such as this, the Report concludes, could remove the threat of any satellite within 500 miles of the missile launch point.

Venus Probe—Getting Closer

ON May 18 or 19 the latest Russian space probe will pass within 62,000 miles of Venus, well inside the gravitational field of the planet, according to the latest information published in *Pravda*. By the time it reaches the vicinity of the planet it will have travelled nearly 170 million miles. The Earth will be more than 43 million miles from Venus when the probe passes by.

This new information indicates that the probe will go closer to Venus than originally announced. The first Russian announcement said that it would pass within 112,000 miles of the planet in the second half of May. The fact that it will pass closer suggests that the probe carries course-correction rockets which have been fired by radio-command signals from the Earth. All the Russians have said about this is that the probe contains a " guidance system."

Also *Pravda* stated that the probe was a cylinder 2.03 m. long and 1.05 m. in diameter (5 ft. 8 in. by 3 ft. 5 in. dia.). It weighs 1,420 lb. and has two banks of solar cells attached to the main body; these can apparently be moved so that they catch the maximum of sunlight. There are four aerials, including a large directional one.

Russian ships are stationed around the World to receive transmissions from the probe. The Russians say that communication is established with it at five-day intervals by means of a giant directional antenna which can be aimed with great precision at any point of the sky. This is probably why they have not called on the 250-ft. dia. radio telescope at Jodrell Bank, although last week they sent the directions in which this telescope should be pointed to receive signals from the probe. Prof. Sir Bernard Lovell, director of Jodrell Bank, suggests that the Russians are using a steerable telescope of 100-200-ft. diameter and probably receiving benefit from directional trans mitting aerials in the probe.

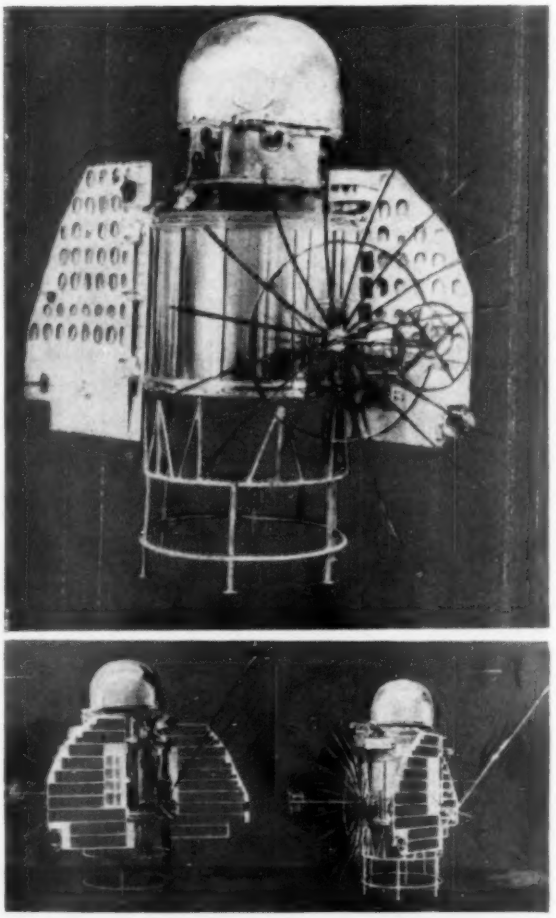
Jodrell Bank could well be very useful when the probe has travelled farther into space. Transmitting at 5W, the American Pioneer V probe passed out of radio range from Jodrell Bank at a distance of 22.5 million miles. The Russian probe is almost certainly using much greater transmitting power.

On p. 237 of this issue, Mr. Stuart Greenwood gives some further consideration to the future movements of the Venus probe. His article was written before the revised figures of the probe's trajectory had been released last week-end in *Pravda* Of the latest information, Greenwood writes:

" The transfer time is now 96 or 97 days, the launch date being Feb. 12 and arrival due on May 19 or 20. This is 39 or 40 days after Inferior Conjunction (Apr. 10). Venus will be ahead of the Earth/Sun line at that time, and the distance separating the two planets will be about 43 million miles as compared with the figure of 26 million miles at closest approach.

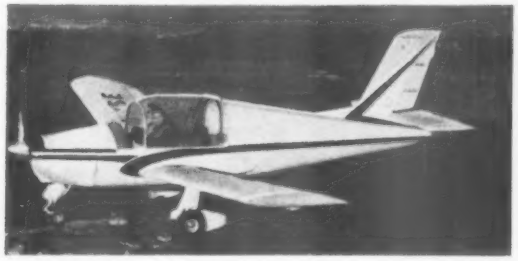
" It now appears that the data given in the article on the 100-day transfer orbit is a closer guide to the subsequent behaviour of the probe than the data on the eight-month ellipse.

" The orbit will be perturbed by the gravitational attraction of Venus and there is a possibility that it may be further modified by guidance."



RUSSIA'S LATEST.—Banks of solar cells and two aerials—one directional—are evident in these photographs of the Russian Venus probe. The photographs are of poor quality and appear to have been extensively retouched, for Russian newspapers.

Aviation News in General



NEW RALLYE.—Modified to production standards, the second prototype Morane-Saulnier Rallye, powered by a 100 b.h.p. Continental engine, recently made its first flight. Two-hundred and forty firm orders are claimed.

MIRAGE IV FLIES.—Flight-testing of the prototype M=2 Mirage IV (discussed in detail in our issue of Feb. 3) has been resumed after an equipment modification programme. Current development is of the Mirage IV as a weapons system, and the O1 aircraft now sports a ventral radome.

METEOR MOD. — For use at Woomera, minor changes have been made to the Meteor U.16 target drone with the result that it has been redesignated U.21. One change is a modification to the aircraft's command relay-unit. Fifteen Meteor F.8s have been shipped out to Australia to be converted to U.21 standards by Fairey Aviation at Bankstown, N.S.W., and U.16s are being converted to U.21 standard in Britain.

NAVAL BULLPUPS.—Reports in the national Press last week indicated that the Royal Navy is pressing for the purchase of Martin Bullpup short-range ASMs for use with the Sea Vixen and Scimitar. This missile is in full-scale production for the U.S. Navy, Marine Corps and U.S.A.F.

SIKORSKY PROGRESS.—The two Sikorsky S-61L commercial helicopters now flying are currently undergoing F.A.A. flight certification trials before delivery to Los Angeles Airways in the summer. The first flight of a third S-61L, also for Los Angeles, was scheduled to take place this week.

VERTOL TRANSPORT.—As winner of a U.S. Marines competition for an assault transport helicopter, Boeing-Vertol is to produce a tandem-rotor helicopter powered by two G.E. T-58 turboshaft engines. This will presumably be a variant of the Model 107.

MORE MAGISTER. — Following agreement with the German Defence Ministry, Potez and Heinkel have begun work on a four-seat derivative of the Fouga Magister, the CM191. Such an adaptation, with a pressure cabin, was projected by Air Fouga some time ago, and the CM191 is apparently to be ready for exhibition by Heinkel at the Paris Aero Show. It will be powered by two Turbomeca Marboré IVs, each of 1,058 lb. thrust, have a maximum weight of 8,157 lb. and cruise speed of 377 knots. It will be marketed jointly for civil and military use by Potez-Heinkel.

UNITED TRANSPONDERS.—A total of 51 A.T.C. transponders has been ordered by United Air Lines from R.C.A. for its Caravelles and Boeing 720s. These transponders will be able to provide altitude as well as range and direction information to ground radars.

IMPROVED ATLAS.—After three failures, the first successful launching of an Atlas E ICBM was made from Cape Canaveral on Feb. 24. In a 45-min. flight it travelled 7,000 miles down the Atlantic missile range to land about 400 miles west of Cape Town. Total thrust developed on launching is 389,000 lb.

LECTURE CANCELLATION. — The R.Ae.S. Guided Flight Section lecture for Mar. 7, "Guided Weapon Control Equipment," noted in the Aviation Calendar on p. 246 is cancelled.

SPACE RIVALS.—Names of three astronauts to begin final training for sub-orbital tests in Redstone-boosted Mercury capsules were given on Feb. 21. They are Lt.-Col. John Glenn (U.S. Marines), Capt. Virgil Grisson (U.S.A.F.), and Cdr. Alan Shepherd (U.S. Navy).

TWO IN ONE.—The double-satellite launched on Feb. 21 from Cape Canaveral by a Thor-Able Star booster was only partially successful. Intended to enter a near-circular orbit at 500 miles and spring apart for separate operation, they remained attached to the final rocket stage which assumed an eccentric orbit with a 617-mile apogee and a 104-mile perigee. One was a 250-lb. Transit navigational satellite and the other a 54-lb. Lofti satellite intended to obtain data on the effect of the ionosphere on radio signals.

MERCURY TEST.—An Atlas launched an unmanned Mercury capsule 107 miles high and 1,425 miles down-range from Cape Canaveral on Feb. 21. Test was for recovery under re-entry conditions "three times more severe than an astronaut will normally experience." Capsule was later picked up from the sea in good condition.

SPACE ANTENNAE TEST.—The extensible antennae developed by the de Havilland Aircraft of Canada for the S-27 Topside Sounder Satellite (THE AEROPLANE AND ASTRONAUTICS, Feb. 24) will be tested shortly in the nose-cone of a three-stage, solid propellent, Javelin rocket to be launched from Wallops Island, Virginia.

SPACE RODENT.—A white rat, launched in the nose-cone of an O.N.E.R.A. Véronique sounding rocket from the French Hammaguir Military Base in the Sahara on Feb. 22, reached an altitude of 93 miles and was recovered alive. The nose-cone parachuted to earth some 28 miles from the launching site. Main object of the experiment was to study cerebral reactions under weightlessness. Electrodes implanted in the rat sent to a ground station variations in electrical impulses in its brain and muscles; pulse and respiration rates were also telemetered.

TWIN SATELLITES.—Launched from Cape Canaveral on Feb. 21, Transit III-B and the Lofti "Pick-a-back" satellite mounted on it, failed to separate from the final booster stage and went into an unplanned orbit.

Commercial Aviation Affairs

ALOHA ARGOSIES.—A scheme to use aircraft instead of ships for a freight and passenger ferry service between the islands of Hawaii is to be considered in Honolulu this month. Aloha Airlines has suggested using a fleet of six Armstrong Whitworth Argosies, initially with a small subsidy. The existing sea ferries are also subsidized.

AUSTRALIAN NAVAIDS. — The Australian Department of Civil Aviation is evaluating three short-range navigation systems—Decca, TACAN and VOR/DMET—for possible Australian use. The tests, which are being conducted principally in N.S.W. are expected to be completed in June, but the system selected will not be operational before 1966 at the earliest.

AIR INDIA ACCORD.—An agreement between Air India and Aeroflot will allow the two airlines "beyond" rights through Moscow and Delhi respectively. Subject to Government approval Aeroflot plans to extend its Moscow-Delhi service to Rangoon and Djakarta.

THE U.S. STRIKE.—The disrupting strike by the flight engineers of seven U.S. airlines (see last week's issue, p. 214) ended on Feb. 23 for six of these airlines —Pan American, American, T.W.A., Eastern, National and Flying Tiger. The seventh, Western, refused to give the agreed assurance that no reprisals would be taken and announced that it had discharged its 130 engineers and would use pilots in their place. The strike was in protest against a federal order that pilots and engineers should select one union.

(*More news on page 239*)

Air Transport

Battle for the Short-haul Market

THE announcement last week-end that Lufthansa is to order 12 Boeing 727s may be a significant one for the British aircraft industry.

At the best it reduces by one the number of the important European carriers which might have been customers for the D.H.121 Trident or the Vickers VC11. At the worst it may mean that three other European buyers will be lost. Lufthansa is a member of Air Union and this decision may sway those of the other members—Air France, Alitalia and Sabena—if any serious programme of fleet standardization is being considered by this still-embryonic consortium. The future of the VC11 depends on the promise of orders from operators in addition to Trans-Canada, which has shown positive interest in this project.

Six of Lufthansa's 727s are due to be delivered for the 1964 summer season and the remainder during 1965. The 727 has so far been ordered by two big U.S. domestic carriers, Eastern Air Lines (40) and United Air Lines (40). Its most direct competitor, the Trident (which has more than a year's start on the 727) has been ordered by B.E.A. (24) for initial deliveries in 1963.

Debating London's Airport Problems

A VERY thorough and well-informed debate on London's airports in the House of Lords on Feb. 23 did not produce an answer to one of the principal questions being discussed —whether the increased landing charges are justifiable in relation to the total charges at other equivalent international airports.

Lord Shackleton and Lord Mills, the Paymaster-General, both spoke of the need for a computer to make comparable calculations for different airports as given in ICAO's *Manual of Airport and Air Navigation Facility Tariffs*.

Anyone who has tried, from scratch, to work some of these tariffs "by hand" and to convert them to a standard currency will agree that it is a monumental labour which does not, even then, provide the complete answer. But we would have thought it worthwhile for the Ministry of Aviation to obtain some representative inclusive figures to support any contention that future U.K. fees will not, in fact, be the highest (but one) in the World. In the current (Feb. 25) issue of *The Economist* a letter from Mr. H. J. Gorecki, financial director of IATA, states categorically that "when the new fees go into effect in the United Kingdom their airports will certainly be the most expensive in the World, with the possible exception of Khartoum, regardless of how the costs are computed."

The debate, which was opened by Lord Ogmore, covered a very wide field indeed—from unified A.T.C. to monorail services and from road developments to executive flying—and provided, for the reader of *Hansard*, a fairly thorough outline of past, present and future plans to improve the overall air and associated ground transport situation in the London area and elsewhere.

The Air-freight Business

SINCE the proceedings of IATA rates conferences are secret—and everybody concerned is in fear of incurring the risk of some preposterous fine for speaking out of turn—information about them is usually disseminated very slowly indeed. However, some odds and ends can sometimes be pieced together to make a semblance of sense.

The disagreements in Paris over the North Atlantic freight rates were primarily concerned with the weights of the consignments which should offer the biggest reductions and about the extent to which commodity rates should be retained. In simplest terms, therefore, the major battle seems, to the outsider, to have been one between those carriers with plenty of all-freight-aircraft capacity and those whose principal need was to find adequate and regular fill-up loads for their passenger aircraft.

If, for instance, you have, like Seaboard, a fleet of CL-44s coming along, then you will be happy to have the most attractive rates for 20-ton consignments, and if you have a fleet of converted DC-7Cs or L-1649s then you will prefer big discounts for 10-15-ton shipments. But, if you have no long-range all-freight aircraft, and you depend on fill-up loads for 707s or DC-8s, then you will need to attract consignments of one ton or less.

By way of comparison it might be explained that the present overall North Atlantic freight-rate reductions (apart from those

(*Continued on page 227*)

ORLY VIEW.—The new Paris Orly terminal—which was opened on Feb. 24 and is described on page 228—can be seen to the left of this picture, fronted by the parking apron. The main road which passes under the terminal and then under the main E-W runway can also be discerned.

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ARGOSY
AND
ARGOSY C. Mk. 1

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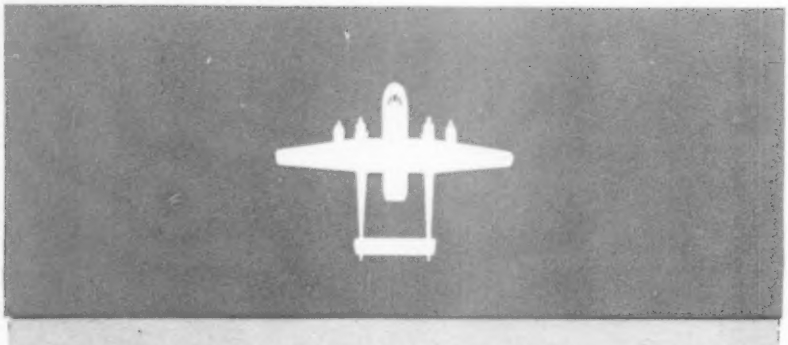


BRITISH OXYGEN AVIATION SERVICES

win 'ARGOSY' contract for liquid oxygen system

Sir W. G. Armstrong-Whitworth Aircraft Ltd. have awarded to British Oxygen Aviation Services the contract for the liquid oxygen installation in the "Argosy" 660. Already production versions of the NA 39, Folland Gnat Trainer, Sea Vixen, Lightning and Gannet are flying with liquid oxygen breathing equipment and components supplied by British Oxygen Aviation Services. Through British Oxygen Aviation Services, BOC serve and service the world's aircraft.

BRIDGEWATER HOUSE · CLEVELAND ROW · ST. JAMES'S · LONDON S.W.1

Air Transport . . . .

(*Continued from page 226*)

for special commodities) apply at weights of 45 kg. and 500 kg.

Obviously there would be many other permutations and combinations within the proposed "weight-break" patterns. Every passenger carrier, however effective his freighter fleet might be, has also to attract fill-up loads and nobody will want to attract very-low-density loads. The existing cargo rate pattern has, in fact, been developed to suit the fill-up technique and old habits die hard.

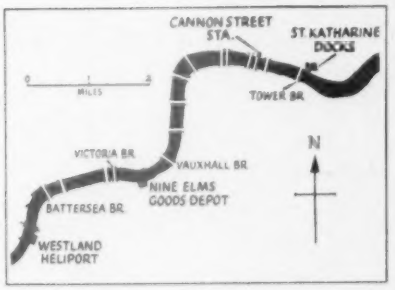
When very attractive rates for big consignments are considered there is also the risk that the airlines (and the smaller ones in particular) might lose control of their freight business. The agent will tend to become the key figure as the collector of loads to make up the big, cheap-rate consignments, and shippers and consignees will tend to deal with him rather than directly with the airlines.

There appears to be little doubt that the carriers were almost, if not quite, unanimous at Paris in their wish for cuts and for simplifications in the rate system. Specialists can prove again and again how money can be saved by the regular use of air freight even at present rates. But this saving for a business is often dependent on a total reorganization of its system of distribution and stockholding. With a few notable exceptions, businesses have not been prepared to consider complicated plans for reorganization—but few of them will refuse to consider the effects of really substantial cuts in the rates.

Still No Heliport Decision

THE technical committee which was set up in July, 1959, by the then Ministry of Transport and Civil Aviation to study the problems of the siting of a heliport for London concluded its work and produced a draft report several months ago.

According to a reply given in the House of Commons on Feb. 20 by Mr. Geoffrey Rippon, Parliamentary Secretary to the Minister of Aviation, the committee has since been asked to examine certain aspects of the problem in more detail and the Minister has authorized further technical studies.



The committee suggested three possible sites—all of them beside the Thames. These were the Nine Elms Goods Depot (on the south bank between Victoria Bridge and Vauxhall Bridge); Cannon Street Station (on the north bank, east of Southwark Bridge); and St. Katharine Docks (on the north bank, immediately to the east of Tower Bridge). The positions, with that of the present Westland Heliport, are shown on the sketch map above.

Navaids in Europe

JUDGING from reports by observers of the International Federation of Air Line Pilots' Association at last month's ICAO Limited Regional Air Navigation meeting in Paris, the navigation aid and A.T.C. situation in Europe is a fairly unhappy one. The straightforward reports of pilots may sometimes cause the raising of eyebrows among those versed in the double-talk of good public relations, but the pilots actually use the aids and fly the airways—so they should know what they are talking about and have good personal-survival reasons for the clear statement of simple fact.

The meeting was primarily concerned with the completion of the regional plan for the VOR and DME installations which are the ICAO-approved aids for the World at large. This plan involves the eventual disposition in Europe of 389 VOR and 168 DME. At present 145 VOR and three VOR/DME are operational. The DME total does not include the military TACAN installations which are outside the ICAO regional plan.

Unfortunately there seems to be a wide variation in enthusiasm (and in the amount of money available) among the states which are expected to implement this plan. Some are proposing to install DME at every VOR position; some will provide them only for terminal-area VORs; and others are not doing anything at all. Obviously—whatever views may be held about the overall policy involved—the VOR/DME plan will have failed if it is not rational and complete enough for the eventual use of pictorial presentations in the cockpits—and the computers for such presentations need distance as well as radial information.

Another difficulty concerns those military DME installations (TACAN) which are not part of the plan—and which can cause conflicting navigation information to be received. In the ordinary way VOR and DME frequencies are paired at the same location, so it would be possible for reception from a distant military DME to be assumed to be that from a DME on a civil VOR site. It is, for instance, possible to receive simultaneously the signals from a VOR in Northern Ireland and a military DME in the south of England.

The co-location of VOR and DME is not always possible, and the meeting agreed that separations of up to 100 ft. in terminal areas and 2,000 ft. elsewhere would be operationally permissible.

With the accuracy of VOR radials accepted as $\pm 5°$ it is obvious that the minimum number of transmitters is related to the width of airways and vice versa. An airway (over sea as well as over land) which is 10 n. miles in width requires, on this accuracy figure, VOR separation of not more than 120 n. miles.

A positive international policy, with forward planning of changes in navigation facilities and services, is essential. Such planning involves apparently unimportant, but prospectively dangerous points such as the relative pronounceability (to non-national pilots) of the names of reporting points. No doubt these and other associated items will be discussed at the 1961 IFALPA Conference. Progress may be slow—but it will be positive so long as the pilots keep hammering away at others about the essential needs.

UNITED CHOICE.—The first of United Airlines' 20 Caravelle VI Rs, now in preliminary flight trials, poses against an Alpine background. United expects to take delivery of the first Caravelle in June and to start service by August.

Air Transport . . . .

The New Orly

EUROPE'S newest airport terminal, at Orly, will come into general passenger use on Mar. 8, following its formal opening last week by President de Gaulle. Constructed as part of a master plan for the development of Orly as the major international airport for Paris, the new terminal has a number of features which, from a preliminary inspection made last week, seem likely to endear it to travellers.

It has become a basic precept of the Paris Airport Authority that an air journey should begin and end at the airport and not at a city-centre terminal. All formalities, both outward and inward, are now completed at the airport, and the town terminal at Les Invalides is no more than an information and travel bureau for the airlines and the terminus for a direct bus service to and from Orly and Le Bourget. No attempt is made to keep passengers in single-flight groups when travelling to and from the airport or during their passage through the necessary ticketing, passport control and Customs formalities in the terminal building.

This philosophy has led to the growth of what is now known as the Orly system of passenger handling, which has been further refined in the new terminal. A typical international passenger departing from Orly will arrive at the airport by taxi, by private car, by coach from the town terminal, or by one of the regular public bus routes. He will check-in, with his baggage, at one of the airline desks on the ground floor, at which point any registered baggage will be cleared by Customs and transferred on moving belts to a baggage hall running the length of the building, to be sorted on to trucks and taken to the aircraft.

The passenger, accompanied by family or friends, is free to move on to the first floor, where the main departure concourse overlooks the airport. Immediately before embarkation he makes his way through passport control and a second Customs check for hand baggage, and along one of the two fingers (parallel with the front face of the building) to the appropriate gate. Each gate has a small assembly lounge where the passengers for a single flight come together for the first time. The fingers are divided longitudinally by a glass partition to separate international and domestic flights—passengers for the latter move straight into the finger from the main concourse.

Arriving passengers use the same fingers and pass through the Customs and passport check in reverse. They then go down to the ground floor and into the baggage-claim area. Here, the registered baggage is brought in from the hall on moving belts and collected by its owners, with trolleys or porters. Exit from the baggage-claim area is made past a Customs check point, so arranged that passengers who have declarable items in their baggage are withdrawn from the main stream and do not hold up the rapid progress of those who have not.

This, essentially, is the Orly system, around which has been built an impressive terminal building which actually straddles National Highway No. 7 from Paris to Fontainebleu, which, in turn, links with a branch of the Great Southern motorway. This road, in a cutting, is bridged a total of 12 times as it passes across the airport, one bridge carrying the main 10,820-ft. runway. Where it passes under the terminal, at basement level, loading bays are provided to simplify the "logistical support" of the airport.

Basements, on two levels, are taken up by various technical services and by restaurants and shops for the airport staff. As already explained, the ground floor is given over to airline ticket desks, the baggage-claim area and the baggage hall, while the first floor has the main concourse and access to the fingers. Much of the second floor is taken up by facilities—on a lavish scale—for transit passengers, with shops, a restaurant, a church and an 18-room hotel. A selection of public restaurants are available on the third floor, which also houses administrative offices. The fourth floor includes a 40-room public hotel, cinema, exhibition hall and more offices. Various technical services and the airport's administration are on the fifth floor and almost the whole roof of the building is available as a public enclosure.

At present, only the west wing or finger of the new terminal is complete. The east wing, to be finished in 1962, will extend across the front of the existing Orly Sud terminal, which will be rebuilt and incorporated into the new structure. The two wings together will encompass 16 aircraft parks, each defined by a blast screen to reduce noise inside the terminal, with another 11 positions in a second row beyond the first.

Architectural design and furnishing of the new terminal are in a modern style without being unacceptably *recherché* and great attention has been given to detail planning, to help to smooth the traveller's passage. Electronic information-display boards and closed-circuit television will keep everyone informed of aircraft arrival and departure times, while several hundred key employees will carry transistorized radio receivers to remain in constant contact with the control centre.

Further development planned at Orly includes construction of a second main runway, parallel to the first, on the north-west side of the terminal; extending and strengthening the existing pair of secondary runways; adding to the aircraft apron area; and building an air freight terminal, already in process of contruction.—F.G.S.

The Orly terminal as it is seen by passengers arriving from Paris. Opened by President de Gaulle on Feb. 24, it will come into general passenger use on Mar. 8.

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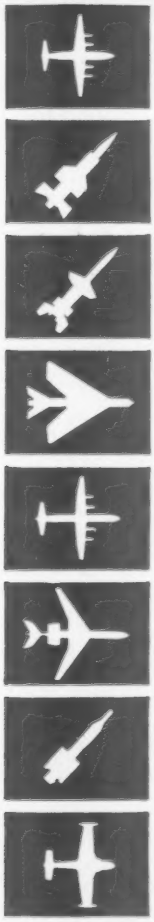

VISCOUNT
VANGUARD
VC 10
BAC 107
SUPERSONIC AIRLINER PROJECT
T-188
CANBERRA
LIGHTNING
TSR-2
JET PROVOST
BLOODHOUND
THUNDERBIRD
VIGILANT
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BRITISH AIRCRAFT CORPORATION

ONE HUNDRED PALL MALL LONDON SW1

TGA BAC31

GHANA

SECOND GENERATION

VC10 projecting the

...and built by **BRITISH**

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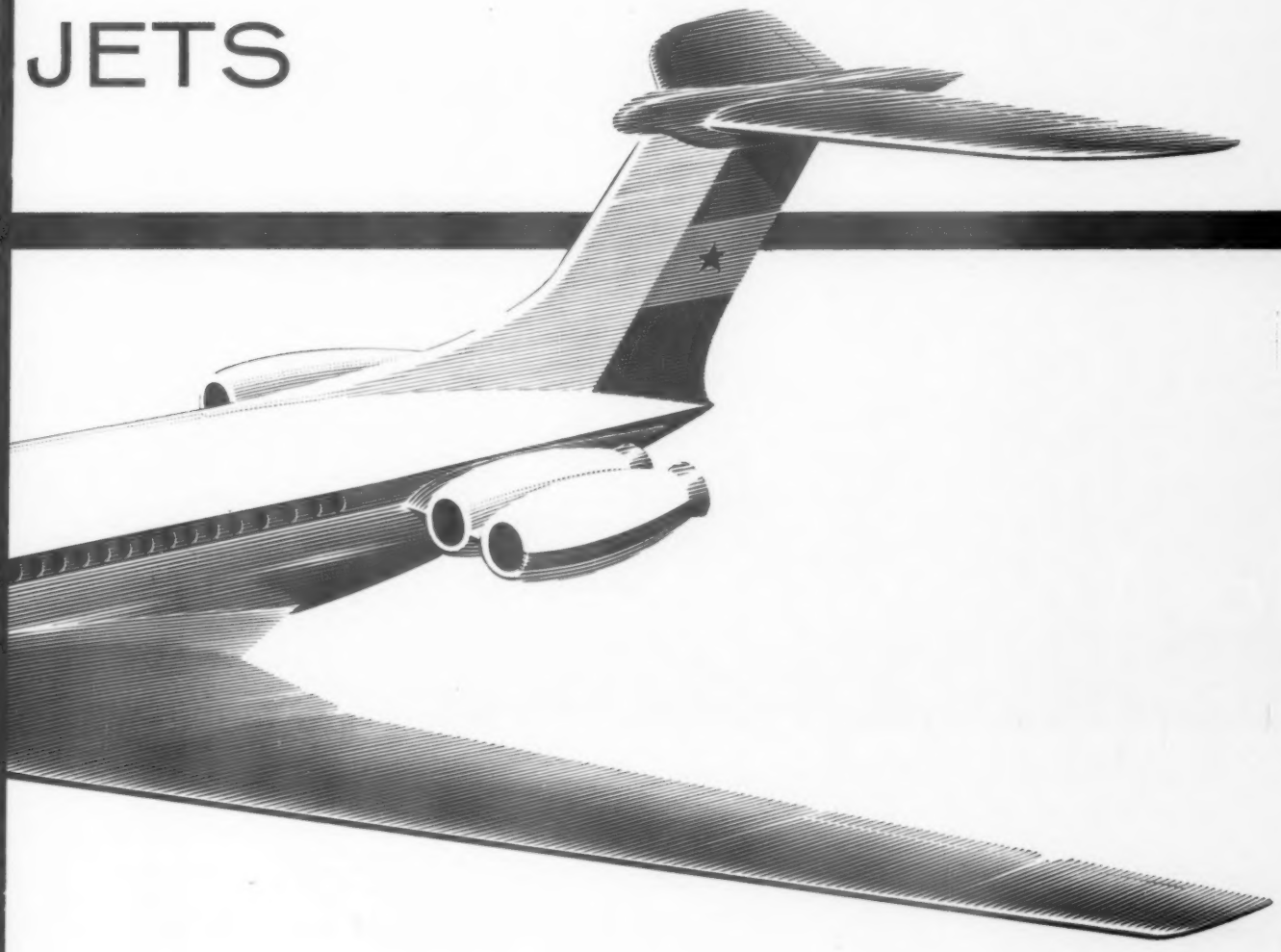
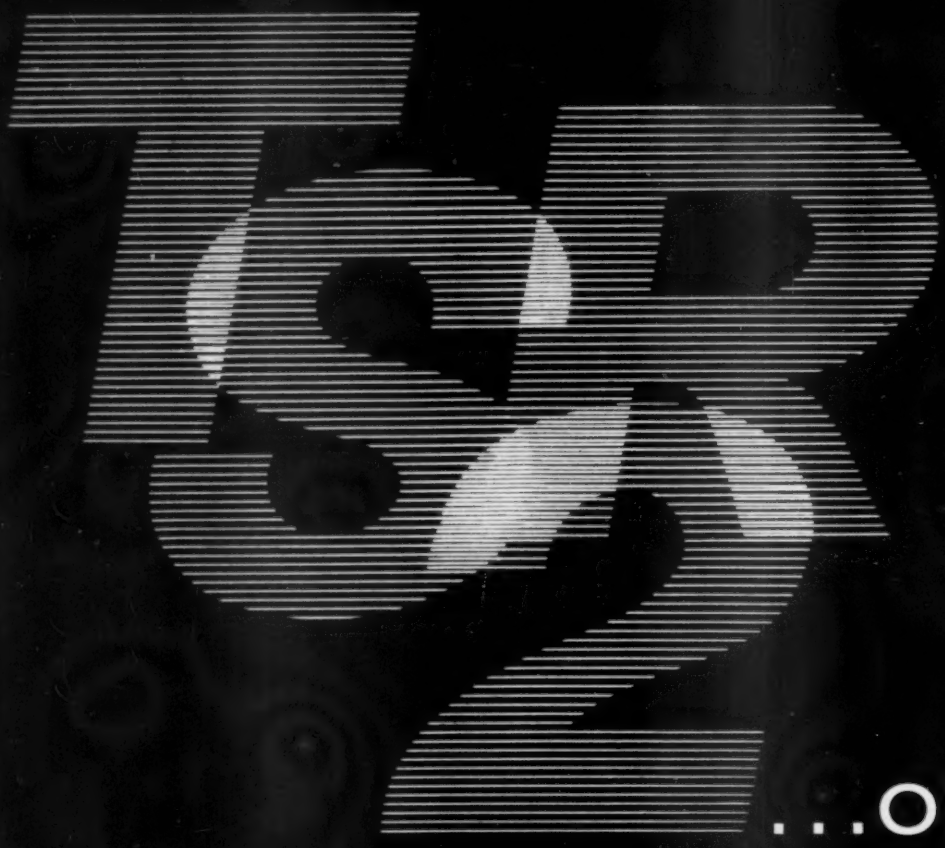


Clean-wing shape of the future

AIRCRAFT CORPORATION

TGA BVC 23



...ordered for The Royal Air Force

During a recent speech, Britain's Minister of Defence, Mr. Harold Watkinson, said of TSR-2...

'One of the principal features of TSR-2 will be its ability to operate at high speeds and at extremely low altitudes .... an automatic terrain following device will enable the aircraft to approach its target beneath enemy radar cover. It should be practically invuinerable to all known forms of counter-attack .... As far as is known, this low altitude performance is not matched by any other aircraft in the world at the present time.'

- **STOL**
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TSR 2

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BRITISH AIRCRAFT CORPORATION

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TGA 8471/A

MARCH 3, 1961

R.A.F. Argosy C.1

Versatile Military Transport

ARMSTRONG WHITWORTH ARGOSIES for the Royal Air Force are now in full production at the company's factories near Coventry. Fifty-six of these aircraft—which have the type designation AW.660—are on order and the first was expected to make its maiden flight this week.

Known as the Argosy C.1, the R.A.F. version is closely related to the civil transport Argosy, 10 of which were built by Armstrong Whitworth as a private venture. Civil Argosies now have full British and U.S. airworthiness certificates; seven of these aircraft are being delivered to the American operator Riddle Airlines.

The main differences between the military and civil versions are in the fuselage, although the military aircraft will operate at a greater all-up weight—97,000 lb. as against 88,000 lb.—and has more powerful engines. Its Rolls-Royce Dart RDa.8 turboprops are uprated military versions of the RDa.7 and give 2,410 e.h.p. for take-off, or 2,870 e.h.p. with water-methanol injection. The civil Argosy has Dart RDa.7s rated at 2,100 e.h.p. each for take-off.

The military Argosy has a fuselage with a revised crew layout, a reinforced structure, details of which are shown on the following pages, and a "beaver-tail" rear-loading door which can be opened in flight for the dropping of heavy military loads. There are large paratroop doors on both sides of the fuselage and the interior is arranged so that the aircraft can operate in a number of military rôles. There is no hinged freight door at the nose of the fuselage as on the civil Argosy.

A flight refuelling probe can be installed over the cockpit canopy and it is intended that the Argosy C.1 will be used as a strategic transport as well as in the tactical rôle as a close-support transport. The aircraft will be operated as a troop transport; as a freighter; for paratrooping or dropping equipment and supplies; and for ambulance duties. Loads of up to 29,000 lb. can be carried.

As a troop transport the C.1 will carry up to 69 fully

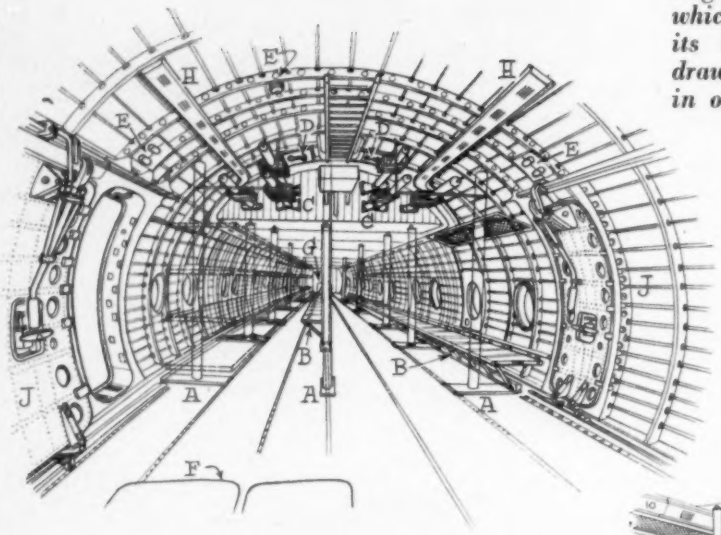
(*Continued on page 233*)

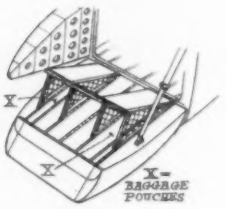
LOADING TRIALS.—Test flights and loading trials were made with a "development prototype" of the military Argosy C.1. This was a modified civil Argosy with the "beaver-tail" or "crocodile-jaw" rear-loading door of the military aircraft.

R.A.F. Argosy C.1 . . . .

Fuselage Layout and Structure

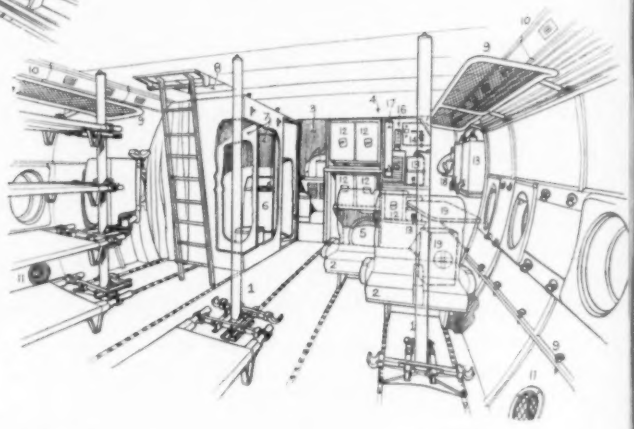
These drawings by J. H. Clark show the internal layout of the military Argosy and the structural features which distinguish the aircraft from its civil counterpart. A cutaway drawing of the civil Argosy appeared in our issue of November 21, 1958.

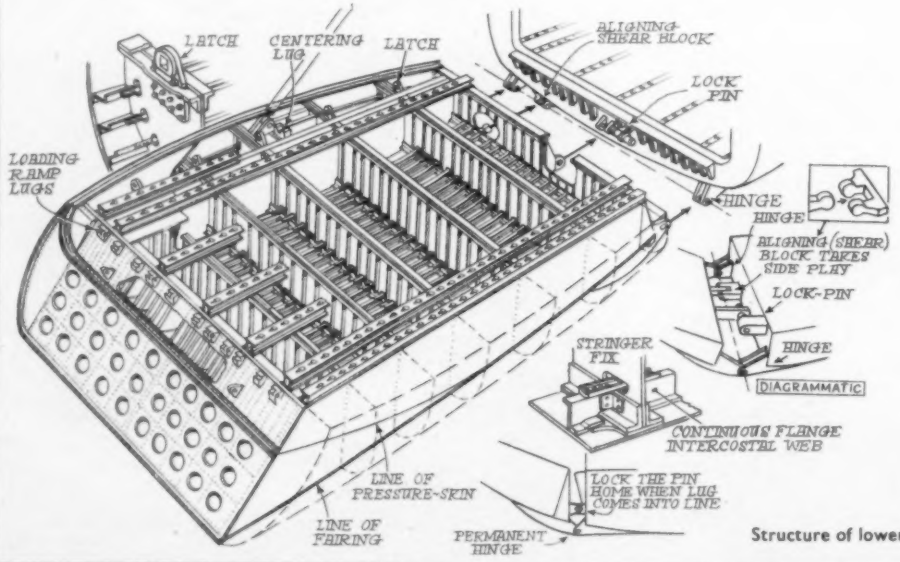




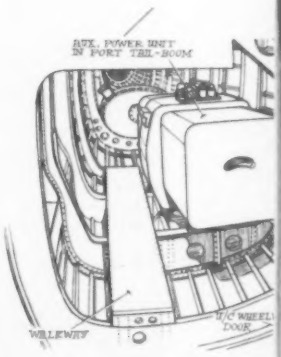
INTERIOR LAYOUT
(above and right)

A. Position of 48 stretchers.
B. Position of alternative para-troop seating (each side) and luggage racks for ordinary seating.
C. Stowage for 12 stretchers.
D. Dinghy releases.
E. Parachute alarm bell and lights.
F. Dispatchers seats.
G. Fixed nose (drop-controller in lower half).
H. Pressurizing ducting.
J. Parachute doors.
1. Position of 48 stretchers.
2. Rail-mounted seat.
3. Nose with built-in toilet 3, catering equipment 4, drop-controller 5, built-in hand-basin on inner face 6, with clip-on non-permanent toilets 7.
8. Ladder to flight deck.
9. Alternative fittings (luggage racks, and parachute seats attached to rail).
10. Air ducting.
11. Floor lighting.
12. Food-tray containers.
13. Heated food.
14. Electric urn.
15. Dry-stores locker.
16. Urn and hot-food switches.
17. Cup stack.
18. Electric coffee pot.
19. First-aid kit and table.

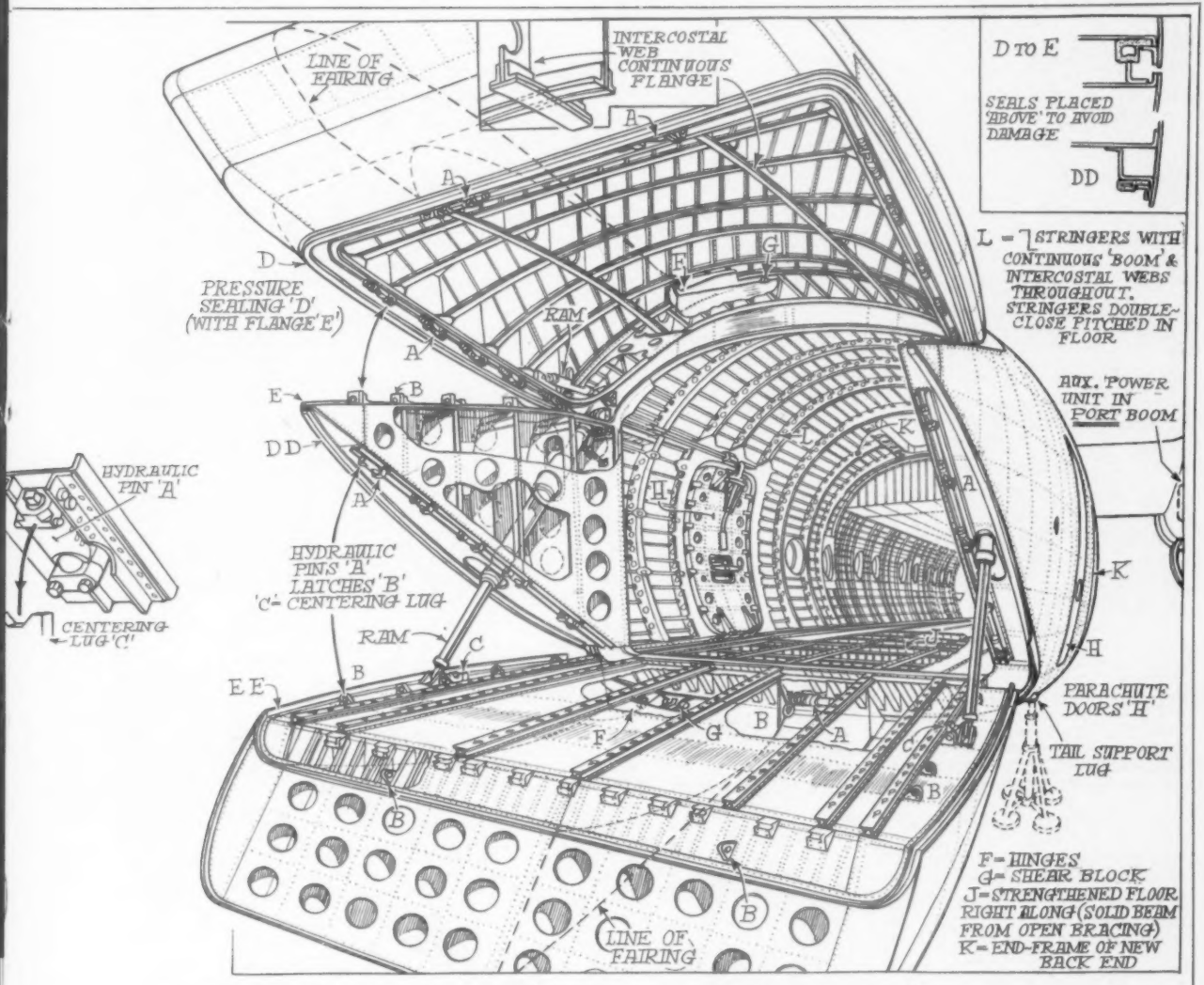




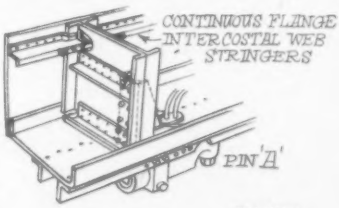
Structure of lower door.

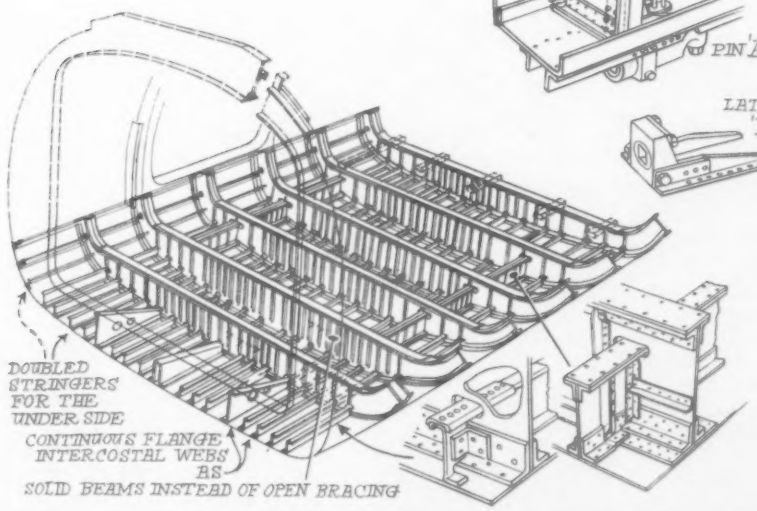


Position of gas-turbine auxilia unit in port tail boom


INTERCOSTAL WEB CONTINUOUS FLANGE
LINE OF FAIRING
D to E
SEALS PLACED 'ABOVE' TO AVOID DAMAGE
DD
L = STRINGERS WITH CONTINUOUS 'BOOM' & INTERCOSTAL WEBS THROUGHOUT. STRINGERS DOUBLE-CLOSE PITCHED IN FLOOR
PRESSURE SEALING 'D' (WITH FLANGE 'E')
RAM
AUX. POWER UNIT IN PORT BOOM
HYDRAULIC PIN 'A'
CENTERING LUG 'C'
HYDRAULIC PINS 'A' LATCHES 'B' 'C'= CENTERING LUG
PARACHUTE DOORS 'H'
TAIL SUPPORT LUG
F= HINGES
G= SHEAR BLOCK
J= STRENGTHENED FLOOR RIGHT ALONG (SOLID BEAM FROM OPEN BRACING)
K= END-FRAME OF NEW BACK END
LINE OF FAIRING

"Crocodile-jaw" door for rear-loading and air dropping of heavy loads.





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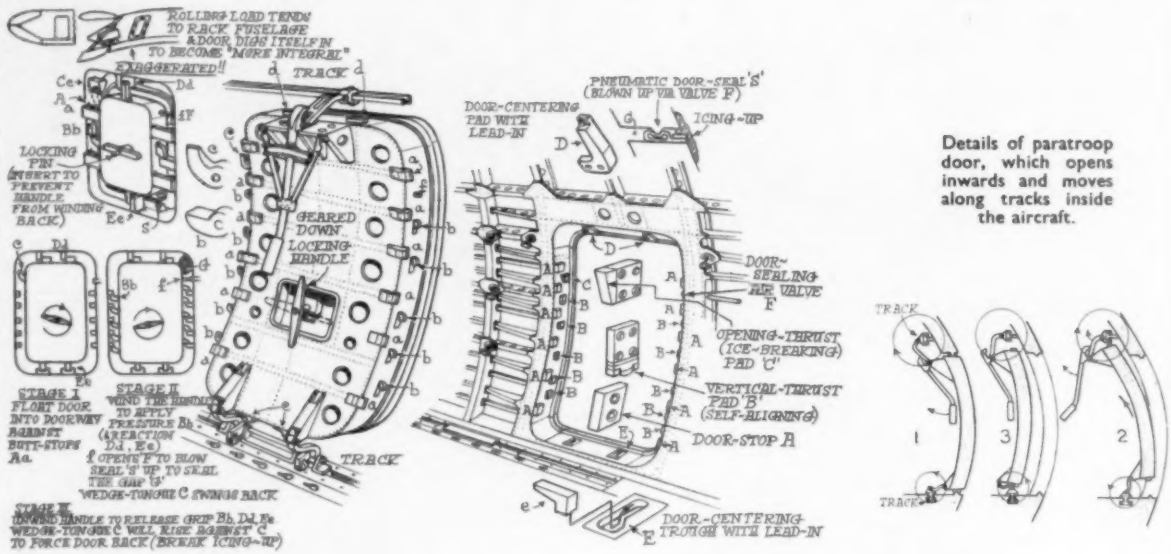
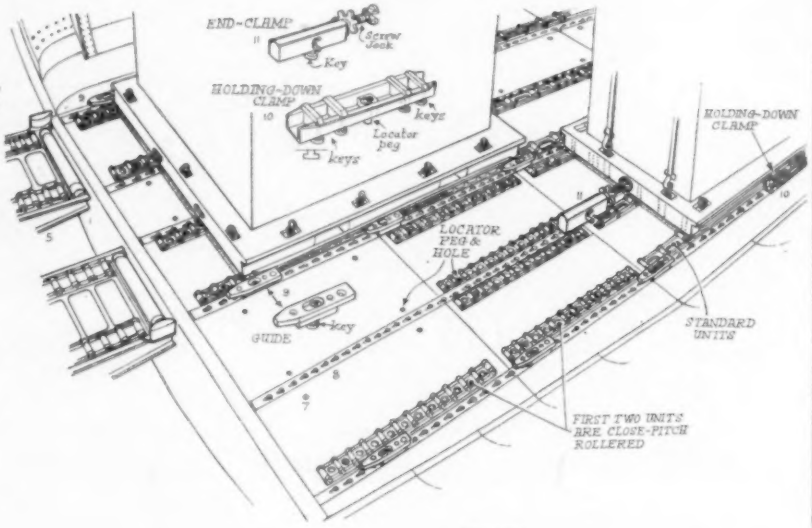
Rear-fuselage floor structure.


ROLLING LOAD TENDS TO RACK FUSELAGE & DOOR DIGS ITSELF IN TO BECOME "MORE INTEGRAL" EXAGGERATED!!
TRACK
LOCKING PIN (INSERT TO PREVENT HANDLE FROM WINDING BACK)
GEARED DOWN LOCKING HANDLE
STAGE I. FLOAT DOOR INTO DOORWAY AGAINST BUTT-STOPS Aa.
STAGE II. WIND THE HANDLE TO APPLY PRESSURE Ba (A REACTION Dd, Ee)
f OPENS F TO BLOW SEAL 'S' UP TO SEAL THE GAP 'g'
WEDGE-TONGUE C SWINGS BACK
STAGE III. TURNED HANDLE TO RELEASE GRIP Bb, Dd, Ee
WEDGE-TONGUE C WILL RISE AGAINST C TO FORCE DOOR BACK (BREAK ICING-UP)
PNEUMATIC DOOR-SEAL 'S' (BLOWN UP VIA VALVE F)
DOOR-CENTERING PAD WITH LEAD-IN
ICING-UP
DOOR-SEALING AIR VALVE F
OPENING-THRUST (ICE-BREAKING) PAD C
VERTICAL-THRUST PAD B (SELF-ALIGNING)
DOOR-STOP A
DOOR-CENTERING TROUGH WITH LEAD-IN
TRACK
1
3
2

Details of paratroop door, which opens inwards and moves along tracks inside the aircraft.

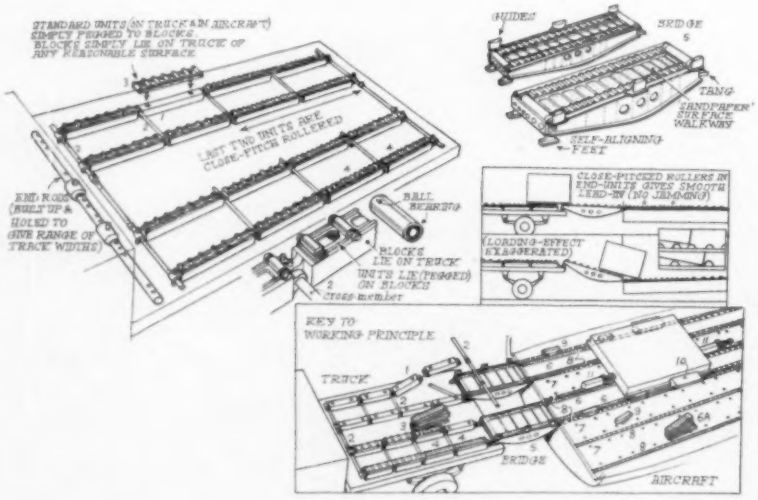
R.A.F. Argosy C.1 . . . .

Drawings by J. H. Clark, A.R.Ae.S.
Copyright "The Aeroplane and Astronautics."



Rolamat System

Developed by Armstrong Whitworth, this loading system is suitable for military versions of the Argosy. In the interests of standardization it is not installed on R.A.F. Argosy C.1s.



TRUCK

On any reasonable truck surface lay blocks 1, link-up to cross-connect as at 2, lay and peg-locate roller units 3 (with close-pitched units for first two lengths, as 4, 4). Erect bridge 5.

AIRCRAFT

Take roller-units from the back 6A and lay them out on floor in lines as required (as at 6) locator-pegging into holes (at 7). Close-pitched (double number) rollers in first two units take the concentrated loading and give smooth entry. Six built-in flush floor-rails 8 take guide-blocks 9 to guide pallet along rollers, take holding-down clamps 10 and end-clamps 11 (to hold pallet and load when stored). Note clamps 11 always fixed one way (one "blocks," the other "screw clamps").

PRODUCTION.—A total of 56 Argosy C.1s is on order and the R.A.F. expects to have six in service by March next year.

R.A.F. Argosy C.1 . . . .

(*Continued from page 229*)

equipped men in triple and twin seats. Seat rails allow the internal arrangement of the fuselage to be changed rapidly. There are overhead luggage racks and galley facilities, and the "beaver-tail" rear door is used as a kit-bag stowage. Despite its large loading doors, the aircraft is pressurized to a differential of 5.5 p.s.i. for all its rôles. A liquid oxygen system is available for emergency use.

As a freighter the AW.660 can carry large and bulky military loads. Fuselage capacity is 3,680 cu. ft. and the rear-door entrance is 8 ft. 8 in. wide and has a maximum height of 8 ft. 6 in. The freight floor is 4 ft. from ground level—at truck-bed height—and the lower part of the "beaver tail" forms part of an integral loading ramp for vehicles.

The floor carries a 20-in. grid of standard 10,000-lb. lashing points; there are also lashing points on the fuselage sides. The usable length of the fuselage is 46 ft. 10 in., equally disposed about the forward C.G. limit. Although not used on R.A.F. Argosies, the A.W.A. Rolamat system can be installed in the aircraft and will be available for other military operators who buy Argosies.

The C.1 has a power-operated winch, complete with snatch blocks and pulleys, for loading heavy freight or wheeled vehicles. During loading, weights up to 5,000 lb. can be taken on the sill of the lower door without the fuselage tipping. Hydraulic struts are used to support the rear fuselage when heavier weights are loaded.

Up to 54 paratroops and two dispatchers can be carried on the three rows of folding seats installed for this rôle. The outer rows along the fuselage side face inwards and the centre row faces to port. There are sliding paratroop doors 6 ft. by 3 ft. in size on each side of the rear fuselage.

When the aircraft is used for dropping paratroops or supplies a supply aimer is included in the crew. He has a window in the nose of the aircraft to give a forward and downward view over the dropping zone. Blind-dropping facilities are also available.

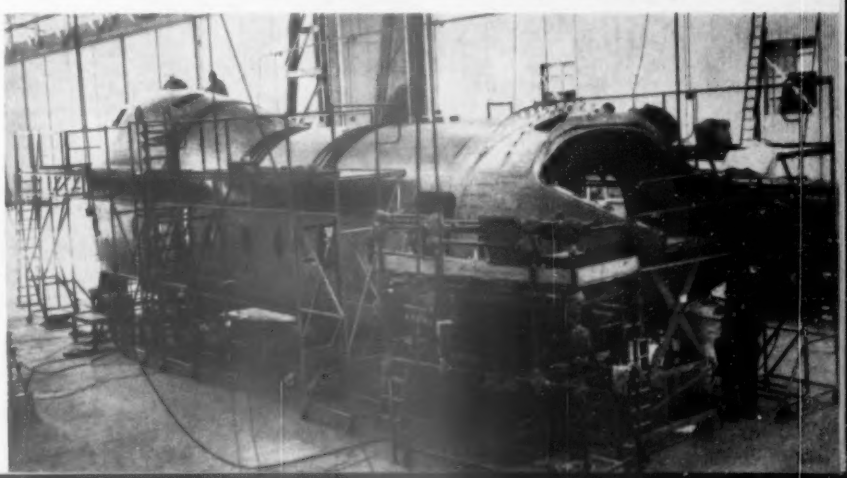
For the air-dropping of equipment and supplies two platforms each capable of taking a 14,000-lb. load can be carried in the fuselage. They are located on a roller conveyor which is continued on the lower section of the rear door. When the load is to be dropped a pendulum-release parachute frees the platform and pulls it out of the aircraft. It is then supported by its main parachutes. The large rear loading doors can be opened and closed in flight; they are hydraulically operated.

One-ton containers can also be dropped by the aircraft using its roller-conveyor system and twin overhead anchor cables.

As an ambulance aircraft the AW.660 can carry up to 48 stretchers, four medical orderlies and two medical supply chests. Life rafts can be carried for all personnel in addition to the dinghies normally stowed in the upper surface of the wings.

A wide range of British and U.S. missiles can be carried in the military Argosy. Examples are: Honest John, Hound Dog, Nike-Hercules, Sergeant, Bloodhound, Lacrosse, Seaslug, Mace and Corporal.

Details cannot be given of the radio and navigational equipment in R.A.F. Argosies, but Armstrong Whitworth offer a wide range of equipment to other military operators. This includes HF, VHF and UHF radio, and Decca, Doppler and ADF for navigation. Standard intercom is fitted at all crew positions. ILS and cloud and collision warning radar are offered as



FIRST ARGOSY C.1.—The fuselage of the first military Argosy was nearing completion when this photograph was taken; it shows clearly the reinforced structure which carries rear-door loads.

standard systems and provision has been made for blind-landing equipment. Autopilot and integrated flight system are installed to customer's choice.

Flight Deck Arrangements

Located above the freight hold, the flight deck has positions for first and second pilots, a flight engineer and a navigator. The crew enter the flight deck by climbing a lightweight retractable ladder from the freight hold. The access door is just behind the first pilot; and a seat for a supernumerary crew member is mounted on this door. There is an escape hatch in the roof at the rear of the flight deck for use after ditching.

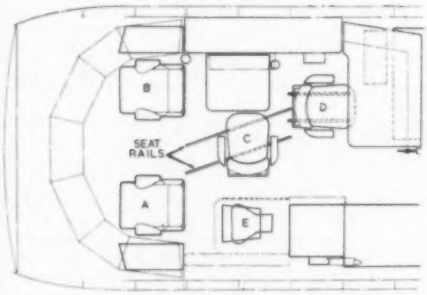
Instruments and controls are grouped and duplicated so that either pilot can control the aircraft. Most of the radio, electric and air-conditioning equipment is grouped on the flight deck so that it is accessible during flight.

A Rover gas-turbine auxiliary power unit is mounted in the port tail boom of the AW.660. It provides power for engine starting and for ground electrical and hydraulic checks. It is not normally used in flight, but in emergency it can provide hydraulic power for closing the freight doors of the aircraft.

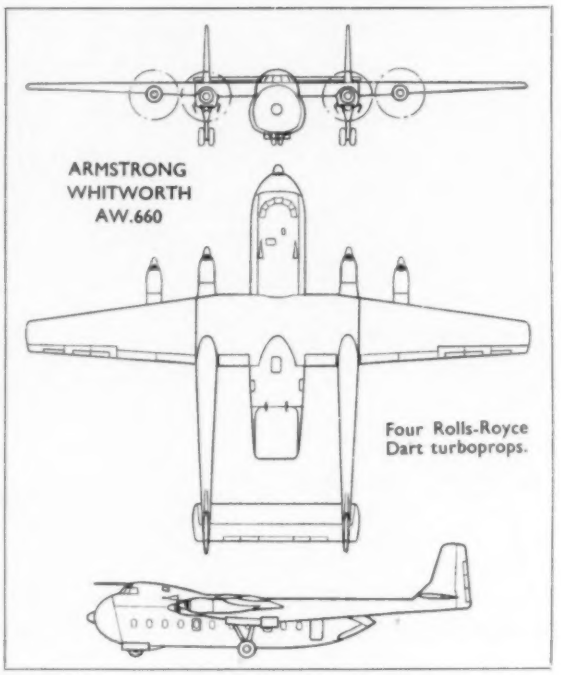
When the aircraft is to be refuelled in flight, a standard refuelling probe is mounted above the flight deck so that the pilot can see it clearly. The fuel line is kept outside the pressurized part of the fuselage and enters the wing at the leading-edge. For normal fuelling the aircraft is pressure refuelled at points on the port and starboard undercarriage, either or both of which can be used. Explosion-suppression equipment is fitted in all fuel tanks.

Wheels of the Argosy's tricycle undercarriage have low-pressure tyres which allow the aircraft to operate from grass or temporary airfields. Tropical and cold-weather tests with the civil Argosy have demonstrated its ability to operate from rudimentary airfields.

The airlift ability of R.A.F. Transport Command will be considerably increased when its 56 Argosy C.1s are in service. As the accompanying photographs show, production is well under way, and the aircraft will enter R.A.F. service in quantity next year. By March, 1962, the R.A.F. plans to have five Argosy C.1s in service.



FLIGHT DECK.—R.A.F. Argosies have a flight crew of four; the civil Argosy was designed for operation by a crew of two pilots only. Crew members are A, first pilot; B, second pilot; C, flight engineer, whose seat moves on rails so that he can sit facing forward between the pilots; D, navigator. There is also a seat, E, for a supernumerary crew member; this folds and is mounted above the entry hatch from the main hold of the fuselage.



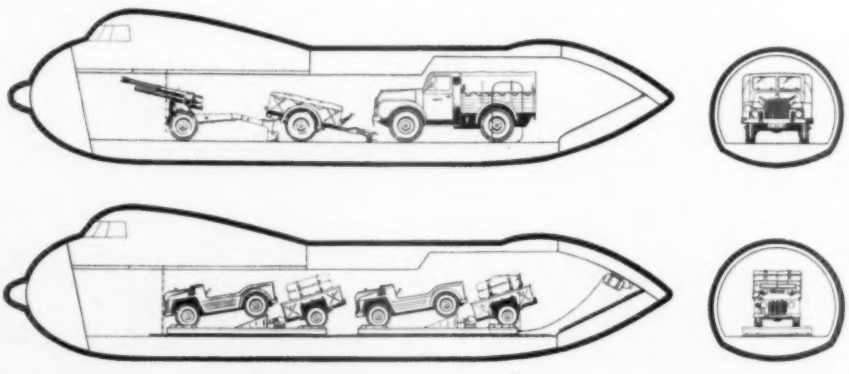
TECHNICAL DATA

DIMENSIONS: Span, 115 ft.; height, 27 ft.; overall length, 85 ft. 4½ in.; fuselage length, 66 ft. 11½ in. Wing area, 1,458 sq. ft. Internal length of fuselage floor, 46 ft. 10 in.; max. width at floor level, 10 ft.; internal height, 6 ft. 8 in.; height over last quarter, 8 ft. 6 in.

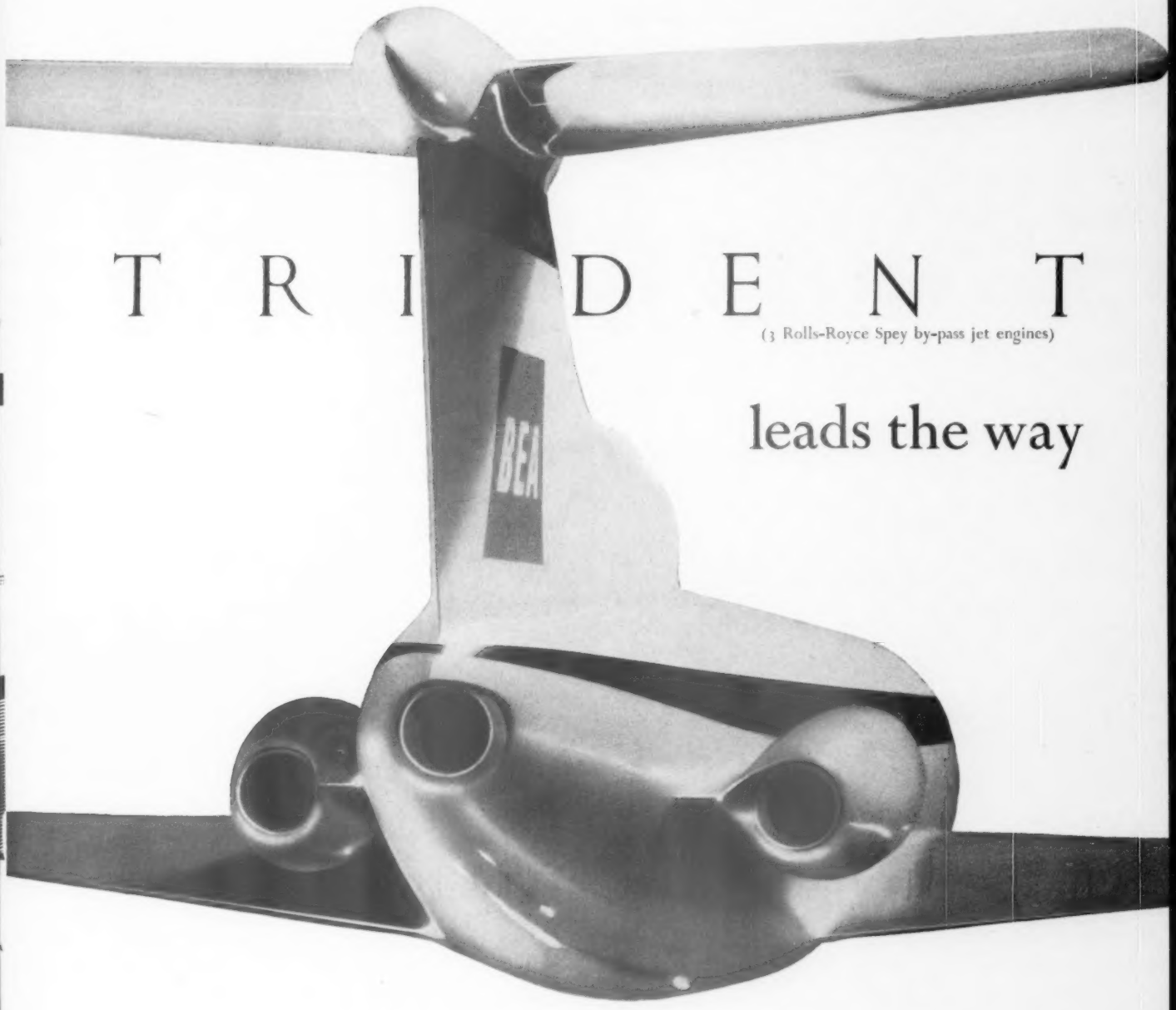
WEIGHTS: Max. take-off, 97,000 lb.; overload take-off with long-range tanks, 103,000 lb.; max. landing 90,000 lb.; max. payload, 29,000 lb.; zero-fuel, 85,000 lb.; capacity fuel load, 33,280 lb.; basic weight, 56,000 lb.

POWERPLANT: Four Rolls-Royce Dart RDa. 8 Mk. 101 turboprops. Take-off power, I.S.A. sea-level, 2,410 e.h.p.; with water-methanol injection, 2,870 e.h.p.

PERFORMANCE: Take-off balanced field length, at 97,000 lb., sea level I.S.A. conditions, 4,800 ft.; sea level I.S.A. +20° C. conditions, 5,400 ft. Ranges with fuel reserves 20% of flight plan fuel or 1½ hr. holding at 5,000 ft. with 29,000 lb. payload, 500 n.m.; with 20,000 lb. payload, 1,200 n.m. Ferry range with additional tanks and take-off at 103,000 lb., 3,000 n.m. Average cruise speed, I.S.A. conditions at 20,000 ft., 80,000 lb. A.U.W., 14,200 engine r.p.m., 233 kt. Ceiling at 90,000 lb., all engines operating at 15,000 r.p.m., 21,000 ft. Three-engine ceiling at 85,000 lb., 15,000 r.p.m., 15,000 ft. Approach speed, 113 kt. Landing distances from 50 ft. at 90,000 lb., sea level, wet concrete: I.S.A. conditions, 3,020 ft.; I.S.A. +20° C. conditions, 3,220 ft.



MILITARY LOADS.—A typical load which the Argosy can fly into advanced areas is a 25-pound gun with a one-ton trailer and one-ton truck (top). It can air-drop two ¼-ton trucks and their ¼-ton trailers (bottom).



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SHAPE Appointment

AIR COMMODORE R. G. SEYMOUR, C.B., C.B.E., has become Deputy Assistant Chief of Staff (Plans and Material) at Supreme Headquarters Allied Powers Europe.

An equipment officer throughout most of his Service career, Air Cdre. Seymour was until recently Director of Equipment (B) at the Air Ministry, having previously been Senior Equipment Staff Officer at Headquarters, Coastal Command. In March, 1952, he was given command of No. 390 Maintenance Unit at Seletar, Singapore, later becoming Base Commander there.

Arabian Peninsula A.O.A.

AIR COMMODORE L. MacD. HODGES, C.B.E., D.S.O., D.F.C., has become Air Officer in charge of Administration at Headquarters, British Forces Arabian Peninsula, with effect from the first of this month.

Until recently the Assistant Commandant of the R.A.F. College, Cranwell, Air Cdre. Hodges was closely associated with the V-bomber force in its early days. After spending a year with Vickers he commanded the Operational Conversion Unit at Gaydon, and then commanded the V-bomber station at Marham. In 1958 he commanded the detachment of Valiants which represented Bomber Command in the U.S.A.F. Strategic Air Command Bombing and Navigation Competition at March A.F.B., California.

R.N. Carriers and Aircraft

DURING the coming year four Royal Navy aircraft carriers and two commando carriers will be operating with the Fleet, or preparing for service with it. Of the four aircraft carriers, three will normally be operational throughout the year and the fourth will be refitting. H.M.S. "Victorious" will return to home waters when relieved by "Centaur" east of Suez in October, and the carriers "Hermes" and "Ark Royal" will operate west of Suez.

The commando carrier "Bulwark" will be serving east of Suez with a commando embarked. When the second carrier in this class, H.M.S. "Albion," commissions after her conversion to the commando rôle, she will rotate with "Bulwark" between the eastern and western fleets. So that one of them will be continuously available east of Suez.

At present undergoing modernization, the aircraft carrier "Eagle" is having a new system installed for the handling of information and the control of weapons. This makes full use of the latest techniques in automation and will increase the speed and accuracy of the carrier's target handling.

On the aircraft side an Intensive Flying Trials Unit—No. 700 "Z" Squadron—is to be established to undertake the Service trials of the Buccaneer later this month. The first operational unit to be equipped with this low-level strike aircraft is expected to be formed in 1962.

The Wessex, the Navy's new anti-submarine helicopter and its first to be capable of carrying both the homing torpedo and dipping asdic, is still undergoing trials and development. The first operational Wessex squadron is planned to embark in the carrier "Ark Royal" in the autumn of this year. Planned to arm the new "Leander" and "Tribal" class frigates, the Westland Scout (P.531) light torpedo-carrying helicopter represents a major advance in anti-submarine warfare. Production has also started in this country of an American-designed lightweight anti-submarine torpedo for use by helicopters.

R.A.F. Appointments

THE following are among recent Royal Air Force appointments:—

Air Ministry: Gp. Capt. M. P. C. Corkery, A.F.C., to the Department of the Air Member for Supply and Organization; Wg. Cdr. W. J. Simpson, D.F.C., to the Department of the Chief of the Air Staff.

Bomber Command: Wg. Cdr. D. T. Fisher to R.A.F. Finningley as Senior Technical Officer; Wg. Cdr. E. W. F. Hare to R.A.F. Lindholme as Wing Commander, Operations and Training.

Fighter Command: Wg. Cdr. K. G. Thomson to Headquarters as Command Armament Officer.

Coastal Command: Gp. Capt. E. F. J. Odoire, D.F.C., A.F.C., to R.A.F. St. Mawgan to command.

Technical Training Command: Gp. Capt. A. E. Lowe, C.B.E., D.F.C., to Headquarters, No. 22 Group, as Senior Air Staff Officer; Wg. Cdr. L. G. Ash to R.A.F. Uxbridge as Deputy Commanding Officer; Wg. Cdr. H. A. Lax to R.A.F. Catterick to command the Administrative Wing; Sq. Ldr. J. R. Tanner to R.A.F. Hereford to command the Boy Entrant Wing, with acting rank of Wg. Cdr.

Maintenance Command: Wg. Cdr. R. G. Nelson to the R.A.F. Airfield Construction Depot, Wellesbourne Mountford, to command the Training and Development Wing.

R.A.F. Germany: Wg. Cdr. E. B. Haslam, M.A., to Headquarters as Command Education Officer; Wg. Cdr. D. S. Sanderson to Headquarters for equipment duties.

Middle East Air Force: Sq. Ldr. G. Wynn to No. 264 Signals Unit, Cyprus, to command, with acting rank of Wg. Cdr.

British Forces Arabian Peninsula: Wg. Cdr. C. C. Vidot, M.R.C.S., L.R.C.P., D.P.H., to Headquarters as D.P.M.O.

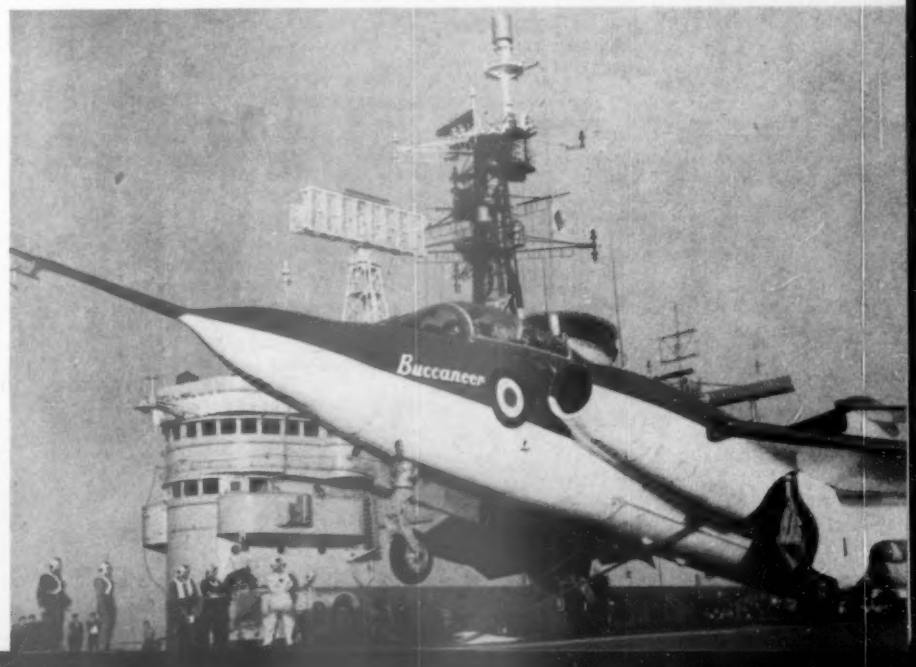
Other Appointments: Gp. Capt. W. D. Hodgkinson, C.B.E., D.F.C., A.F.C., A.D.C., to the Ministry of Defence; Wg. Cdr. I. D. Crozier, A.F.C., to the Ministry of Aviation.

More Service News

No. 2 Squadron Reunion.—A reunion dinner of No. 2 Squadron will be held in London on Apr. 14. Tickets, price 21s. 6d. each, and further details may be obtained from Flt. Lt. A. J. Gunn, Officers' Mess, R.A.F. Jever, B.F.P.O. 25.

R.A.F. Remembrance.—Eight books of Remembrance, bearing the names of men and women who gave their lives while serving in the R.A.F. and its associated Services during World War II, will be placed in the R.A.F. Church of St. Clement Danes on Sunday, May 7. An American volume will be dedicated at a separate service on the same day. Two other R.A.F. volumes, as yet incomplete and covering the period up to Sept. 2, 1939, and the period since the War, will be dedicated at a later date.

No. 125 Wing Reunion.—The first combined reunion of Nos. 96 and 256 Squadrons, which comprised No. 125 Wing, 2nd T.A.F., at R.A.F. Ahlhorn from 1952 to 1958, will be held at the Oxford University Air Squadron Headquarters on Apr. 15. Officers wishing to attend can obtain tickets, price £1 each, from Flt. Lt. R. D. Bates, R.A.F. Pitreavie Castle, Dunfermline, Fife, Scotland.



BUCCANEERING.—Intensive Service flying trials with the Blackburn Buccaneer are due to start later this month with the formation of No. 700 "Z" Squadron at R.N.A.S. Lossiemouth. Seen here aboard the carrier "Ark Royal," the Buccaneer is expected to be in front line squadron service next year.

Air Estimates 1961-62

THE supreme importance attached by MR. JULIAN AMERY, Secretary of State for Air, to the qualities of flexibility and mobility in a modern fighting arm (so forcefully demonstrated in World War II) is apparent on perusal of his most readable and comprehensive Memorandum to accompany the Air Estimates, 1961-62 (Stationery Office, Cmd. 1292, 3s. 6d.).

At home and overseas the various Commands retain their discrete identities—those at home organized on such a basis as to ensure their immediate readiness to reinforce those overseas whenever and wherever need arises. While technical advance is paramount throughout, Transport Command, which has trebled its capacity over the past 10 years, is to be still further augmented to fit it for performance of three principal tasks: moving the Army's strategic reserve, moving naval reinforcements, and supporting the redeployment of Royal Air Force squadrons to reinforce the air defence of our overseas bases and provide additional air support for our forces.

The net total of Air Estimates for 1961-62 is £526,670,000, compared with Estimates and Supplementary Estimates for 1960-61 of £535,460,010, before taking into account the receipt of £2m. from the Federal German Government. The strength of the R.A.F. on Apr. 1, 1961, including W.R.A.F. and boys, will be 158,700 (against 163,450 a year ago), with a civilian complement of 100,192.

Aircraft and equipment stand at nearly £214m., which gives a quite staggering average figure of some £1,350 per serving member of the R.A.F.

Operational Provisions

Bomber Command

The Memorandum states: "The threat today is mainly from enemy bombers. In a few years' time it will be mainly from enemy missiles. But even when there may be only a few minutes' warning of missile attack, V-bombers at dispersal and readiness will still be able to fly many miles clear of their airfields within the warning time available. The speed of reaction of the Mark 2 V-bombers and their equipment ensures that the 'V' force will continue to provide an effective deterrent under our independent control during the next decade."

Of weapons, Blue Steel service trials are to begin this year, and the air-launched missile Skybolt, now being developed in the United States, will be introduced in the mid-1960's. Production weapons will be bought outright, minus warheads, and will be fitted with British warheads.

"The current level of expenditure on the deterrent, inclusive of the capital and running costs of the V-bomber force, its airfields, nuclear weapons, and research and development, together with the running costs of Thor, represents about 10% of the Defence Budget," i.e., about £165m. This percentage figure has been given unchanged by the Government for the past five years.

A development contract has been placed for the T.S.R.2, a strike reconnaissance aircraft of high supersonic speed at altitude and low-level penetration ability, with a wide radius of action and no need for elaborate airfield provision.

Fighter Command

Orders have been placed for the Lightning Mk. 3, which will carry an improved air-to-air guided weapon. Practical progress in in-flight refuelling has improved the fighter's ability to reinforce overseas theatres at short notice.

Bloodhound 1 will be completely deployed in this country during the year, and orders are being placed for Bloodhound 2 which, being air transportable, can reinforce overseas Commands.

Work has begun on a new high-performance radar system, which will include computers and data-handling equipment needed for the interception of supersonic aircraft. This system will be concerned only with aircraft, and so will not overlap but will complement the functions of the ballistic missile early warning station in process of erection. Further, it will form part of the integrated civil and military air traffic control organization now being set up.

The point is made that when the existing manned bomber threat is overtaken by a missile threat, fighters will still have a rôle in preventing reconnaissance, investigating unidentified movements, and safeguarding our radar system against jamming.

"Expenditure on air defence, world-wide, is expected to absorb somewhat less than 10% of the Defence Budget. Of this about one-third is attributable to the requirements of the deterrent."

Transport Command

Here is seen the big expansion, both in fixed and rotating-wing aircraft. Currently, Transport Command's strategic force consists of 23 Britannia's and 10 Comet IIs, and this is now to be strengthened by the acquisition of 10 Belfast freighters and five Comet 4Cs. The Belfast—the largest aircraft ever to enter R.A.F. service—will have a payload exceeding 35 tons, and is intended primarily for rapid emergency deployment of heavy and bulky equipment such as armoured cars and guided weapons. Its normal range of over 4,000 miles can be extended by refuelling in flight.

To the medium-range, or tactical, fleet—at present 48 Hastings, 32 Beverleys and 12 Valettas—are to be added five Argosy C.1s this year, with more to follow.

Helicopter strength is to be much increased for its specialized duty of supporting the Army in the field. This year will see the entry into squadron service of the twin-rotor Belvedere, and first deliveries of the turbine-engined Whirlwind are expected. A later introduction will be the twin-engined version of the Wessex, with improved load capacity.

Coastal Command

Shackletons, already carrying new radar, navigation equipment and submarine locating gear, will be provided with more accurate means of locating survivors afloat and with better communications. Besides their primary rôle of naval co-operation, Shackletons stand ready to reinforce overseas Commands in internal security, keep surveillance over guided weapon ranges, report floating oil patches and co-ordinate air search and rescue operations.

Overseas Commands

In R.A.F. Germany, the Canberra tactical atomic strike force has been provided with new all-weather navigation equipment, and the Swift FR.5 is about to be replaced altogether by the Hunter FR.10 for fighter-reconnaissance duties.

In the Near East later marks are to re-equip the Canberra strike force.

In the Middle East fighter ground-attack squadrons have now been fully re-equipped with the Hunter FGA.9.

In the Far East the fighter force will be augmented by the introduction of the Javelin and Hunter FGA.9, while Belvedere helicopters will increase the Command's capacity for tactical support.

The R.A.F. Regiment

The Regiment has been regrouped to provide a strategic reserve at home as well as local airfield defence overseas. The fire and rescue services, for which it is responsible, have been reorganized.

Training Provisions

The basic flying-training schools have been largely re-equipped with Jet Provosts, to be followed later in the year by an improved version with the more powerful Viper II engine. After basic training pilots will be selected for specialization, and will carry out advanced training on Varsities, Vampires (to be replaced by Gnat) or helicopters, according to rôle. The helicopter training school is being enlarged in view of the expansion of the helicopter tactical support force.

The R.A.F. continues to provide flying and technical training at its schools for members of Commonwealth and foreign air forces. There are R.A.F. missions and training teams in Jordan and the Lebanon, and R.A.F. pilots are helping in the training of the German Air Force. At the invitation of the Ghana government, some 150 officers and men of the R.A.F. are being seconded to Ghana to help in the training and development of the Ghana Air Force.

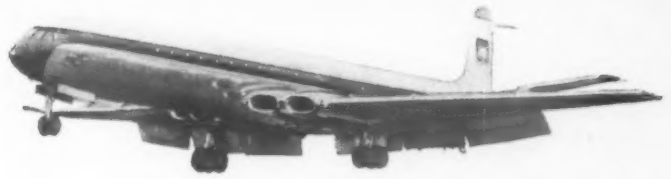
Meteorology

Promising results are being shown by research directed to development of a trustworthy system of mathematically forecasting major pressure changes by the use of high-speed electronic computers and to further exploration of the upper atmosphere. The Meteorological Research Flight now covers Mediterranean and tropical areas.

General

Because of the expansion in Transport Command and because the V-bombers with stand-off weapons are expected to constitute the deterrent for the next decade, more aircrew recruits are needed than in recent years, and the Secretary of State's opinion is that the R.A.F. will need as many pilots in the 1970s, and perhaps even in the 1980s, as today.

Summing up, he says: "The V-bomber force, equipped with British nuclear weapons, is capable today of dealing such a devastating blow to any aggressor that I think we can say here and now that we are safe from any premeditated attack. This power of ours will, in our judgment, continue to grow simultaneously with the capacity of any potential aggressor to deal with it."—O.W.H.C.



On the landing-wheels of the D.H. 'Comet'

The undercarriage of the de Havilland 'Comet' is of particular interest since it has a four-wheel bogie, effective in giving improved running on second-rate runways.

As shown in the part section of one of the wheels, special features are the Dunlop high-duty disc brake, used when braking after touch-down, and the motor-driven fan, used to cool the wheels before the next take-off.

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The Company recognises the need to segregate advanced thinking from the hustle and distraction of the factory. Accordingly, in addition to the Group Research Laboratories at Roke Manor and other specialised research centres already existing in the U.K., extremely well equipped laboratories have recently been established at West Leigh for advanced telecommunications studies.

It is in these establishments that the next generation of telecommunications equipment is already taking shape.

In close support at all times are the complete resources of the Plessey Group of Companies which include unrivalled tool making and machining facilities, a full range of environmental testing and production laboratories, and the services of the materials laboratories at Caswell.

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Towards the Sun

The new Russian probe is travelling on a high-energy orbit. If it passes Venus, the probe will subsequently approach a point almost half way in from the Earth to the Sun. Is it a combined Venus and Sun probe intended to return to the region of the Earth two years after it was launched? S. W. GREENWOOD, M.Eng., A.M.I.Mech.E., A.F.R.Ae.S., *examines the possibilities.*

RUSSIA'S Venus probe has roused more interest in the prospects for interplanetary flight than anything that has happened since the first satellite was launched just over three years ago. The prestige of achieving the first close pass of another planet might have gone to the Americans with their Pioneer V had not the launching been seriously delayed.

Excitement associated with the new launching has tended to obscure the important fact that the probe is probably as much a Sun probe as a Venus probe. It is clear from *Tass* statements that this is the Russian intention.

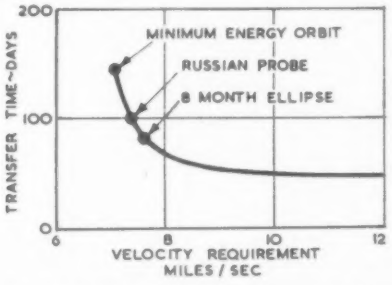

Fig. 1.—Influence of vehicle performance on transfer time to Venus for elliptic orbits within the Earth's orbit tangential to the Earth's orbit.

It has been stated that the probe "will reach the area of Venus in the second half of May, 1961." This gives a transfer time of about 100 days. As this is appreciably less than the time of 146 days for the minimum-energy transfer, the path of the probe will be an ellipse that crosses the orbit of Venus.

As is well known, useful reductions in transfer time in the region of the minimum-energy ellipse may be obtained for moderate increases in vehicle performance requirement. This is shown in Fig. 1, where it is seen that a velocity of about 7.4 miles/sec. applies to the Russian probe, as opposed to 7.1 miles/sec. for the minimum-energy orbit. In arriving at the value for the probe we are assuming that it travels on an orbit tangential to that of the Earth. This may turn out to be not strictly true.

The curve of Fig. 2 shows that a velocity of 7.4 miles/sec. permits an approach to 0.57 of an Astronomical Unit from the Sun. If the probe misses Venus it will therefore journey close to a point half-way between the Earth and the Sun. At this point of its orbit, at perihelion, the incident energy from the Sun will be $1/(0.57)^2$, or just over 3, times its value in the region of the Earth's orbit.

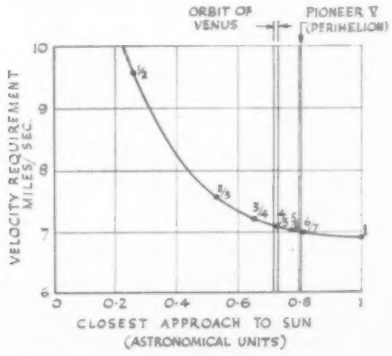

Fig. 2.—Influence of vehicle performance on closeness of approach to Sun for elliptic orbits within the Earth's orbit tangential to the Earth's orbit. Points on the curve represent orbits of special interest having the durations in fractions of a year as shown.

It will be seen from Figs. 1 and 2 that the orbit of the Russian probe appears to lie fairly close to the eight-month ellipse. The velocity requirement for the latter is 7.6 miles/sec. and the transfer time to Venus is 81 days, the probe subsequently approaching to 0.53 of an Astronomical Unit from the Sun. The eight-month ellipse is shown in Fig. 3, together with the position of the Earth at each of the two points of greatest interest on the flight.

From the information available, it seems that the new probe may not swing in as close to the Sun as does the eight-month ellipse. On the other hand, a number of simplifications are involved in the above studies. The probe was launched about four weeks later than expected. The *Tass* statement refers to checking guidance equipment—this might be used to modify the present orbit slightly.

Taken in conjunction with the known sensitivity of transfer times to small changes in the launch velocity, we may reasonably speculate that the eight-month ellipse may be a fairly close approximation to the Russians' intentions. If this is so, the probe will return to the region of the Earth after an absence of two years, having journeyed three times round the Sun.

The *Tass* statement refers to "checking radio communications over super-long distances." At fly-by, the distance separating the probe and the Earth will be about 26 million miles, less than that over which Jodrell Bank communicated with Pioneer V using the latter's 5W transmitter. Reference to Fig. 3 shows that, at perihelion of the eight-month ellipse, the distance over which communication has to be maintained is nearly 0.87 of an Astronomical Unit, or just over 80 million miles. The larger transmitter of 150W in Pioneer V was for communication at distances exceeding 90 million miles.

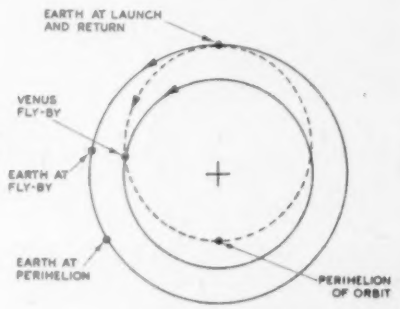

Fig. 3.—The eight-month ellipse used for a Venus fly-by.

On the face of it, the selection of a high-energy orbit for probing Venus appears rather surprising. As illustrated in Fig. 3, the planet lies close to the Earth-Sun line at fly-by. This would be a nuisance for communication purposes at that time, owing to interference effects produced by the Sun. However, the Russian probe was launched at a later date than would be appropriate strictly to the picture given, and Venus would be in position at fly-by ahead of the Earth-Sun line. Inferior Conjunction, when Venus lies on the Earth-Sun line, is on Apr. 10, and arrival after this date permits Venus to move ahead of the Earth.

Some of the data may be stored for transmission when the probe returns to the vicinity of the Earth in two years' time. Should that be so, the next generation of Venus probes will already be off on their journeys, having been launched during the next favourable period in the autumn of next year.

Tube-making in Space

THE method of producing the extensible satellite antennae used in Canada's S-27 Topside Sounder Satellite, described exclusively in our issue last week, is looked upon as having other useful space applications. The antennae in question, which extend to lengths of 37.5 and 75 ft. after the satellite has arrived in orbit, have been developed by The de Havilland Aircraft of Canada.

In addition to its use in antennae systems for ionosphere sweep-frequency sounders and radio-astronomy satellites, D.H. Canada believe the extension technique will have a ready application for removing sensing instruments to a location remote from the body of the satellite, perhaps up to several hundred feet. After measurements have been made, the instrument could be taken back into the satellite. As the antenna tube can be completely retracted after the test, it could serve a secondary useful purpose in increasing the satellite's rate of spin.

Another possible application for the technique might be in the construction of manned space-stations, for which there will be a requirement for structures to be built up in orbit using components which are sufficiently compact to fit within the launching vehicle. Larger tubes of the type described, extending to the required length with suitable end couplings, would be useful for many purposes.

Tasks for the Venus Probe

THE Moscow newspaper *Red Star* gave some information on the tasks to be performed by the automatic interplanetary station now on its way to a rendezvous with the planet Venus, which suggests that its primary objectives may be similar to those of the American solar probe Pioneer V launched on Mar. 11 last year.

The newspaper, published by the Soviet Ministry of Defence, states that apparatus on board the rocket will investigate the density of meteor streams in the depths of space. It will also help to measure the intensity of the Earth's magnetic field at great distances. The vehicle should also help to explain many problems connected with the origin of cosmic rays whose source, they suggest, "could be powerful explosions of stellar material."

Studies are also to be carried out on the composition of interplanetary matter, according to the *Red Star* report. Theoretical calculations show that the density of interplanetary matter should increase nearer the Sun. The apparatus carried will enable these calculations to be checked.

Transatlantic Satellite Tests

A DECISION has been reached to go ahead with the erection in this country of a ground station with a large steerable antenna for use in tests of communication satellites. Readers of this journal will be well acquainted with the projects now under development in the United States which require the use of ground stations in Europe.

Our article, "Orbital Relay Stations" (Jan. 13) dealt with proposals by the American Telephone and Telegraph Company to launch a 150-lb. real-time satellite into polar orbit at 2,500 miles. This is planned to use the Bell Telephone Laboratories ground station at Holmdel, New Jersey, in conjunction with European ground facilities in Britain, West Germany or France. A more recent article, "Go-Ahead for Satellite Relays" (Feb. 3) dealt with the separate NASA Relay project, for which no fewer than 41 American companies were producing proposals by Mar. 6.

The NASA specification calls for a real-time satellite with a mass of 85 lb. ±10% to be launched into orbit by a Delta three-stage rocket. Apogee will be 2,500-3,000 n. miles, perigee 600-1,400 n. miles, period 180 minutes, and inclination to equator 30°-55°.

The American Telephone and Telegraph Company have received a go-ahead for their "private venture" satellite from the Federal Communications Commission and have been allocated frequencies (see table), but it is still not clear whether the company will continue independently or incorporate their project with the NASA scheme. They are listed among the concerns competing for the Project Relay contract.

Whatever may be the outcome of these deliberations, it is clear that Britain will be playing a part in the subsequent test programmes. At the annual dinner of the Telecommunications Engineering Manufacturers' Association on Feb. 15, Mr. Reginald Bevins, Postmaster-General, said (in a speech read in his absence) that to think of World communications only in terms of telephone cables was like thinking of national defence in terms of rifles. These were his actual remarks:

"A U.K. Government team, which included Post Office representatives, recently visited the United States to study satellite communication system developments. This week there was a return visit here when we discussed with the Americans plans for tests of satellite communications across the Atlantic.

"I am convinced of the technical feasibility of such systems, although there are many technical and operational problems to be solved. I am sure that our industry will have an important part to play in the development of the communications equipment; of the equipment for satellites and the ground radio stations for satellite systems.

	NASA RELAY PROJECT	A.T. & T. PRIVATE VENTURE
Transmitter	400 — 500 Mc/s	4,100 — 4,200 Mc/s
Receiver	2,200 — 2,300 Mc/s	6,325 — 6,425 Mc/s

Frequencies allocated for two real-time experimental communication satellites under development in the United States.

"No one really knows what the costs of operating satellite systems will be, but we shall know more about this when we have had some experience with an experimental communication satellite."

Certainly, the electronics industry will be very keen to participate in this work and the development of low-noise parametric and other amplifiers in the one to 10-kMc/s range has been in progress for some time. A few weeks ago, it will be recalled that Decca Radar, Ltd., announced an interest in developing "tracking systems and low-noise receiving systems."

Particular interest is reported in the horn-paraboloid antenna system as used so successfully by Bell Telephone Laboratories in America to receive faint radio signals reflected from the balloon-satellite Echo I. The Bell ground station is illustrated on this page, showing the horn antenna in the foreground. In addition to "unique radio circuitry," the cabin at the small end of the horn houses a ruby maser amplifier refrigerated to −456° F. by liquid helium.

The antenna, 50 ft. long, is rotated by an upright wheel. It also rotates about the base to permit tracking of fast-moving satellites anywhere in the sky.

Bell Telephone Laboratories "telephone terminal to space" at Crawford Hill in Holmdel, New Jersey. It has already been used in conjunction with experiments with the balloon-satellite Echo 1. In the foreground is the special Bell-developed horn-reflector antenna employed as a receiver for the satellite communication system. At rear is the 60-ft. diameter transmitting antenna.

civil or military

twin engine Mobility

Designed primarily for military use, this twin engined twin rotor helicopter, the Belvedere, which has recently gone into service with the Royal Air Force can carry 19 fully equipped troops over a range of 400 nautical miles and can prove to be an extremely useful vehicle in the field of tactical mobility. As a civil passenger vehicle it can be developed as an airliner to carry up to 23 passengers in comfort from city centre to city centre or on feeder line work. A feature of the Belvedere is its ability to operate with full payload on only one engine. The design of the transmission system automatically permits both rotors to be driven by either engine should circumstances dictate. This capability is a special requirement for the commercial use of the modern helicopter and the civil version of the Belvedere is well suited in this respect.

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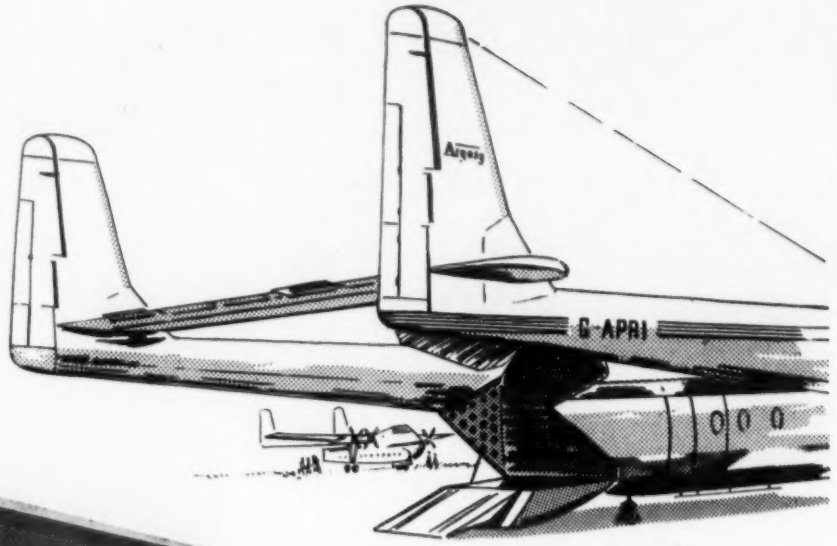

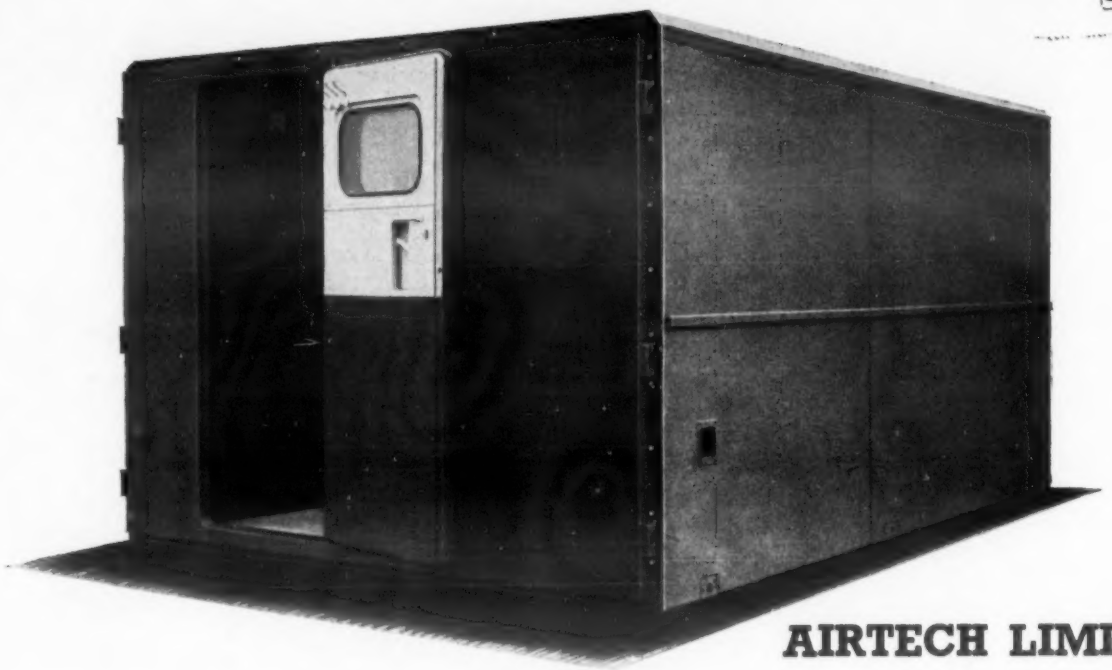

IN AW 660

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(*Continued from page 225*)

SHOPPING FOR VISCOUNTS.—Bids recorded in the latest *Market Report* of the Aircraft Exchange include one from a financial syndicate for six Viscounts, Type 745 or similar. They are for lease-purchase by an airline and the offered price is $450,000 each. Another bid is for a single early type Viscount 700, at $250,000, which is required for conversion to executive standard. This aircraft is to be based in Europe.

B.O.A.C. TO WASHINGTON.—Boeing 707 services to Washington through New York or Boston will be started by B.O.A.C. on Jne. 2, subject to Government approval, and from Jne. 9 will be at a daily frequency.

SKYWAYS' COACH-AIR. — From Apr. 1 the return fares on the Skyways coach-air service between London and Paris will be reduced to £8 10s. (£10 10s. for week-end peak journeys and £6 10s., airport to airport). Through time including one hour's flight will be 5½ hours.

LATER LOW FARES.—B.E.A. will offer reduced excursion fares on certain night and week-end day flights to France, Italy, Portugal, Spain, Gibraltar and Malta during October. Reductions of up to 25% on peak season rates will be made to encourage the taking of late holidays; similar cuts have already been announced for the spring and early summer.

EUROPEAN TRAFFIC. — Statistics prepared by the Air Research Bureau show that its 12 member companies recorded a 20% increase in passenger miles on intra-European international traffic during 1960. Seat miles offered increased by 21% and the passenger load factor went down by 0.6%. In January, 1961, passenger miles increased by 18% and seat miles by 19%.

MORE JET PLANS.—Lufthansa expects to begin flying its Boeing 720s on routes to South America on May 20 and on the Middle East network on Jly. 1. The first of eight 720s ordered by Lufthansa recently made its first flight. Both Swissair and S.A.S. are planning to introduce Convair 990s on their services to South America in September.

ACTIVATING THE ACT.—The Civil Aviation (Licensing) Act (Commencement) (No. 3) Order, 1961, which has now been made, brings into force all the remaining provisions of the Act itself. Among other things the order will have the effect of bringing to an end the Air Transport Advisory Council on Jly. 31 next; the Council is not intended to have any further functions after Mar. 30 but will require time to prepare its final report.

CONWAY CARRIAGE.—Spare Rolls-Royce Conways for Air India are being ferried out to Bombay in the "fifth pod" on Boeing 707s operating scheduled services from London Airport.

AIR SAFARIS SCHEDULE. — The first scheduled operations by Air Safaris are to begin on Apr. 8 with a twice-weekly Viking flight from Hurn to Ostend and Amsterdam. Twice weekly services to Dublin and Belfast will begin on Apr. 16. Air Safaris recently took over Don Everall transport operations and the Falcon Airways fleet and now has nine Vikings and Hermes.

DC-8 POD.—The F.A.A. has now approved the Douglas DC-8 for the carriage of a spare engine in a pod under the port wing inboard of the inner engine. Most operators have specified for this pod to be available on their DC-8s.

SCOTTISH COMMITTEE. — The Scottish Advisory Committee for Civil Aviation held its first meeting on Feb. 14 when it received a briefing on its responsibilities. At the next meeting later this month, the committee is expected to discuss the B.U.A. application to operate a twice-daily passenger service between Edinburgh/Glasgow and London (Gatwick).

PRAGUE TO N.Y.—Air India is to introduce the first through-plane service between Prague and New York, starting May 4. One service a week will be operated, via London.

OXYGEN RULE.—The F.A.A. will require one crew member to wear an oxygen mask at all times in transport aircraft operating above 35,000 ft., under a new rule which became effective on Mar. 3, 1961. All other members of the crew on the flight deck must have quick-donning masks available, which can be put on within five seconds without interrupting the crew's normal duties.

BIRD HAZARD.—The F.A.A. has produced and will circulate to airport managers a booklet entitled "Bird Hazard to Aircraft" which gives advice on how to minimize the possibility of aircraft accidents due to birds. The report is the first phase in a series of studies to be made for the F.A.A. under a $100,000 contract.

CONTRACT CANCELLED. — The U.N. has cancelled its contract with Seven Seas Airline, which had been flying personnel and supplies in the Congo using six DC-4s and C-46s. The company is reported to have flown Fouga Magister jet trainers to Katanga recently.

IBERIA JETS.—Following delivery of its Douglas DC-8s, Iberia Airlines plans to inaugurate a service between Madrid and New York on Jne. 1.

SCOTTISH FERRY.—Channel Air Bridge is planning in conjunction with British Railways to offer a car ferry service to the Continent for Scottish travellers. A car sleeper train would operate four times a week between Scotland and Southend to link with cross-Channel services by Bristol 170s or Corvairs.

News About People

LUFTHANSA CHAIRMAN.—Herman J. Abs has been appointed chairman of the Lufthansa board of directors, in succession to Dr. Kurt Weigelt. He was formerly a director of the Deutsche Bank.

EXPERT ON DITCHING.—Mr. B. W. Townshend has been appointed a technical consultant to the R.F.D. Co., Ltd. He will advise on the ditching safety of aircraft and on questions relating to search, rescue and survival.

E.E.A. CHAIRMAN.—Dr. D. N. Truscott, general manager of the electronics division of G.E.C., has become chairman of the Electronic Engineering Association in succession to Mr. L. T. Hinton. Mr. W. D. H. Gregson of Ferranti has been elected vice-chairman in succession to Mr. R. R. C. Rankin. Redifon, Ltd., has now joined the E.E.A. council and will be represented by Air Vice-Marshal E. B. Addison.

Mr. L. G. Marshall, who has been appointed assistant general manager of the light aircraft engine department of the motor-car division of Rolls-Royce, Ltd.

FAR EAST IATA.—Mr. Val Morehouse has been appointed to take charge of the IATA Far Eastern Technical Liaison Office in Bangkok, succeeding Mr. O. H. Wiles, who has been in temporary charge since August, 1960. Mr. Morehouse has served with ICAO since 1948, including three years in Bangkok.

P.A.L. RESIGNATION.—Col. Andres Soriano has announced his resignation from the management of Philippine Airlines when his contract expires on Mar. 31.

PILOTS' CONFERENCE.—The 16th IFALPA annual conference, which convenes in Mexico City on Tuesday, Mar. 7, will be opened by the President of Mexico. The 1962 conference is likely to be at either Karachi or Stockholm.

Slewed-wing Supersonics

Payload of a Mach-2 transatlantic airliner could be increased between 50% and 100% if a slewed-wing layout were adopted. The principle of the slewed wing and its advantages are surveyed here by G. H. Lee, A.R.C.S., B.Sc., D.I.C., F.R.Ae.S., *deputy chief designer of Handley Page, Ltd.*

"Tiger, Tiger, burning bright
In the forests of the night,
What immortal hand or eye
Dare frame thy fearful symmetry?"

THE word "symmetry" in the well-known lines quoted above is used by William Blake almost as though it summarized the tiger, and symmetry is, indeed, characteristic of nearly all animals. There are very few unsymmetrical creatures; the flat fish is an exception and even this is symmetrical when young, developing asymmetry only through lying on its side.

Because we are so used to symmetry in ourselves and other animals, it requires a considerable effort of the imagination to contemplate a really unsymmetrical aircraft (ignoring minor lack of symmetry in cockpit layouts, etc.), but, because unsymmetrical aircraft have not hitherto received much attention, it does not follow that they are without their advantages. The yawed, or slewed, wing proposal, which is briefly described here, is an indication that, possibly, real benefits might follow in certain circumstances from adopting an unsymmetrical airframe layout.

The drag of a supersonic aeroplane may be divided into three main components: that due to lift; the wave drag due to volume; and the skin friction drag. The drag due to lift may itself also be divided into two parts, vortex drag and wave drag. The vortex drag is reduced as the span of the wing is increased. The wave drag due to both lift and volume is reduced as the fore and aft extent of the wing or body is increased. The skin friction drag is roughly proportional to wetted area. It is therefore clear that the minimum drag should be obtained by keeping the wetted area to a minimum and then so disposing of it that it occupies the greatest possible fore and aft length and the greatest possible length at right angles to the direction of flight.

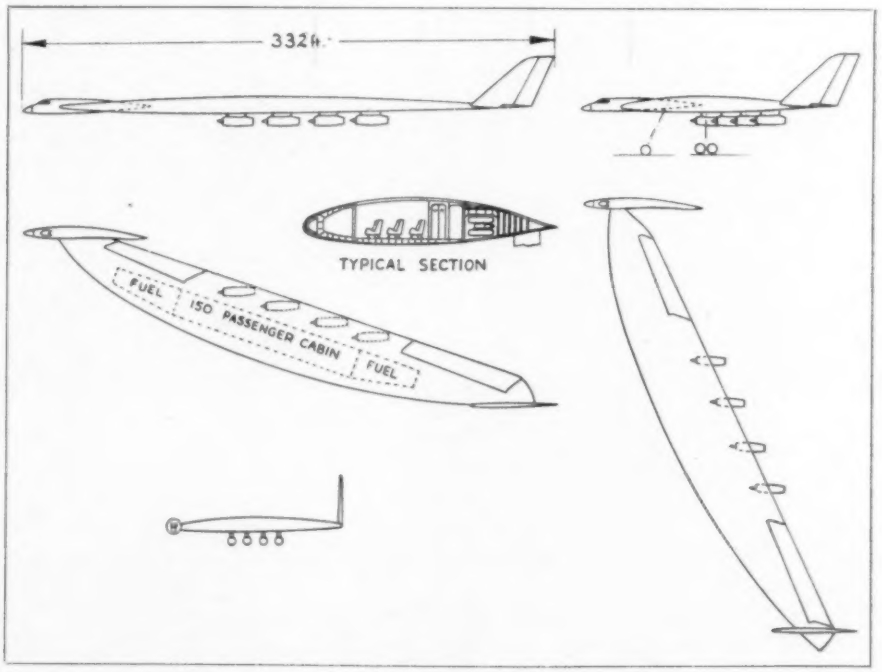
One way of meeting the above requirements is to have a moderately high aspect-ratio wing and arrange it so that it flies diagonally—rather like half a normal swept wing. Sketches on the next page show the comparison between slender delta, swept and slewed wings of the same area and illustrate how the slewed wing occupies greater length and span than the other planforms; in all these cases the span is half the length. The swept and slewed wings shown are only two of the many that could be derived from the basic slender delta.

However, supersonic cruising efficiency is not the only criterion, since supersonic aeroplanes have to take-off and land subsonically and, in any case, have to spend an appreciable part of their time flying subsonically—during the stand-off at airports and so on. For these phases of the flight fore and aft length is not very significant and span assumes relatively much greater importance because all the lift-dependent drag is now vortex drag (old-fashioned "induced drag").

It is for this reason that there is currently much interest in variable geometry for supersonic aeroplanes. The usual solution is to have a highly swept arrow-head type of planform arranged with a joint somewhere on the inner part of the wing so that the tips may be moved forward for the subsonic parts of the flight where span is required, while they are moved back again to give a highly swept wing for the supersonic phases. The main penalty for such a layout is that major shear and bending loads have to be taken through the moving joints, with consequent severe mechanical and structural problems.

The slewed wing consists essentially of a single aerofoil of moderate aspect ratio which is large enough to contain the passengers, fuel and so on, is provided with a crew cabin at the forward tip and has a fin and rudder at the rearmost tip. The engines are slung underneath it in separate nacelles mounted on short pylons. The undercarriage is of the tricycle type.

The slew angle (that between length of wing and flight direction) at which the wing flies is determined by the setting of the fin and rudder relative to the wing. For take-off and for subsonic flying this control surface is set at such an angle that the wing will fly at a slew angle of approximately 60° or 65°; the crew nacelle and the engines are set so that in this configuration they, too, are parallel to the direction of flight. For supersonic flight the slew angle has to be between 15° and 20° and this is achieved by rotating the fin and rudder, the



Possible layout of a Mach-2 slewed-wing supersonic airliner. On the left it is in the cruising configuration, at 72° sweepback. On the right it is in the landing configuration, with 25° of sweep. Control cabin, engines and fin and rudder pivot to vary sweep.

crew compartment and the engine nacelles relative to the wing. It is thus seen that only comparatively secondary loads have to be taken through moving joints since the main lifting structure, the wing itself, is clearly supported on an ideal "air bearing." In this way the structural penalty for variable geometry is minimized.

Control is provided by means of two ailerons, or elevons, and the rudder. By moving the two elevons in an appropriate relationship it is possible to produce either pure rolling or pure pitching and the control system will be arranged so that the normal movements of the pilot's control column produce the right mixture of elevon angles to have the required effect on the aeroplane. The mixture of elevon angles is different for different angles of yaw and the control system is such that the mixture is automatically changed as the slew angle changes.

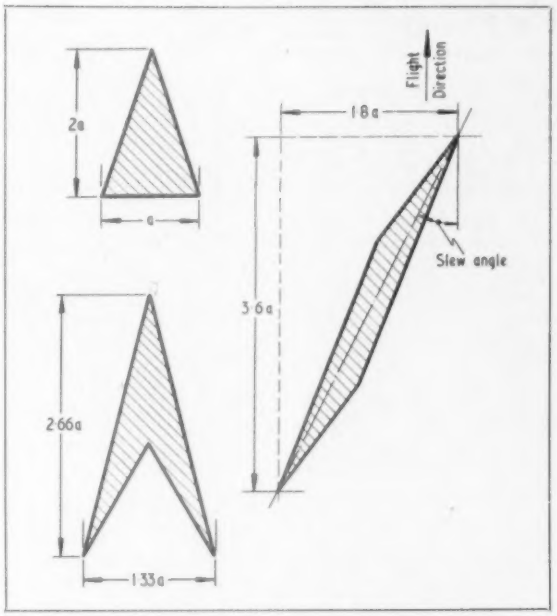
There is plenty of room inside the wing for a comfortable passenger cabin provided that the aircraft is large enough to give adequate headroom. In this respect, the slewed-wing passenger carrier is like any other all-wing passenger aircraft in that there is a certain minimum size below which it is impossible to provide adequate headroom.

With regard to the performance to be expected from such an aeroplane, the lift/drag ratio in supersonic flight at a Mach No. of, say, 2.0 may be expected to be approximately 10 or 11, which is probably 10% or 20% better than might be obtained with the corresponding slender wing configuration. Subsonically, the slewed wing would have a lift/drag ratio of about 24, which is very much better than could be obtained with the slender wing.

In order to illustrate the importance of these improvements, suppose that one considers a transatlantic M=2.0 airliner, having an all-up weight of some 350,000 lb. Comparing, now, the slewed-wing concept with a slender delta-wing layout, it may be estimated that the slewed wing will require some 12,000 lb. less fuel in the supersonic cruise than the slender wing, and will save approximately the same amount in the non-supersonic periods of the flight because of its much better subsonic performance. Thus, the total fuel saving may be approximately 24,000 lb., which is of the same order as the payload carried by the slender-wing design.

On the above assumption, therefore, the slewed wing could potentially carry twice the load of a slender wing. If one wishes to be pessimistic and credit the slewed wing with only the same supersonic performance as a slender wing, then there still remains a potential increase in payload of some 50%—a very worth-while improvement.

In deriving the above figures it has been assumed that the basic equipped weights for the two aircraft are the same; this is reasonable because both structures are basically simple and the wing areas are approximately the same. The weight penalty for the variable geometry part of the slewed wing can be offset against the smaller powerplant required because of the better lift/drag ratio.



Relationship between length and span for slender delta, swept and slewed wings of the same area.

At higher Mach numbers there appears to be little difference in the supersonic lift/drag ratio to be expected between slender and slewed wings, but the extremely high sweeps necessary for a slender wing would make it impossible for it to take off and land normally and, therefore, for such an aeroplane some form of variable geometry, or direct-lift take-off, would be needed. Thus the slewed wing solution might be attractive here.

In conclusion I should like to emphasize that the above results are very preliminary and that the opinions expressed are my own and not necessarily those of my firm. However, I think the results given are sufficiently near the truth to constitute an *a priori* case for giving serious consideration to the slewed-wing concept, the possibilities of which were first brought to my notice by R. T. Jones, of N.A.S.A., during the Madrid Conference in 1958.

Insect Flight

INSECT wing mechanisms could well be studied by those who hope to achieve man-powered flight with flapping wings, instead of confining their attention to imitating the wings of birds. This was one lesson to be learnt from a lecture on "Insect Flight" given to the Man-powered Aircraft Group of the Royal Aeronautical Society on Feb. 10 by Dr. J. W. S. Pringle, F.R.S., who is not only Reader in Experimental Cytology* at Cambridge but also president of the University Gliding Club, so has first-hand contact with aerodynamics.

All insect wing mechanisms follow a basic plan which includes three-point suspension near the wing root, one point being below and two above. The relative position of these points is changed by some tiny moving parts called axillary sclerites, causing the wing to rotate on its long axis in such a way that the leading edge is lowered ("pronation") during the downstroke and raised ("supination") during the upstroke.

Thus the wing incidence is changed actively, and not by passive bending of the surface behind a rigid leading edge. How this is done cannot be explained in words or even in a "still" diagram, so Dr. Pringle produced a delightful animated film showing the little "sclerites" nodding to and fro with each wing beat.

In most of the higher insect groups, the strong muscles which move the wing up and down are, curiously enough, not attached directly to the wing at all. A vertical muscle inside the thorax distorts its cross-section in such a way as to pull up the wing root and cause the rest of the wing, outboard of the suspension points, to go down. Then a longitudinal muscle lying under the insect's back causes it to arch, and the effect of this is to raise the root of the wing and move the rest of it down.

Control during flight is exercised by changing the wing incidence only on the downstroke. We were shown tracings from high-speed motion pictures of a fly, seen head-on. It reacts to a right yaw by keeping the left wing supinated; to a left roll by reducing the pronation of the left wing at the beginning and end of the downstroke; and to forward pitching by doing the same with both wings and even supinating them at the end of the stroke.

Where insects have two pairs of wings to flap, they beat out of phase unless connected; often the rear wing-beat is slightly in advance of the front one. In flies the rear wings have evolved into "halteres," thin rods with blobs on the end, which vibrate through a 180° arc and act as gyroscopes, with the advantage that the Coriolis forces are reversed at the end of each stroke so that their total effect cancels out. This is why flies can fly in the dark.

A peculiar feature of the main flight muscles of most insects is that they contract several times for each nerve impulse which brings the message ordering them to contract. This is because, if nerve impulses arrived at more than 50 per second, the muscle would go into permanent contraction. Yet the wing must flap at a much higher frequency than this. Dr. Pringle has suggested that a so-called "click mechanism" at the wing suspension, which suddenly relaxes the muscle tension during both the upstroke and the downstroke, may explain the phenomenon.

In the discussion Dr. Pringle agreed with Dr. R. C. Rainey, the locust expert (also a glider pilot), that the action of a bird's wings may be just as complicated as that of an insect, but the complication in this case resides in the nervous control of the wing rather than its anatomical machinery.—A.E.S.

* Study of cells.

Personal Flying

NOW that the blow has fallen, and the London Zone is permanently IFR, some of the results to be expected by private pilots in the area can be examined. It seems clear that despite the free lanes giving access to Denham, White Waltham and Fair Oaks, club flying at these airfields will be severely restricted, and they will all become P.P.O. (prior permission only).

The new regulations also virtually prohibit aircraft without radio from making cross-country flights to those airfields, except by flying enormously circuitous routes. From Mar. 1, for example, a Tiger Moth wishing to fly from Stapleford Tawney to White Waltham will normally have to go via High Wycombe and then west almost to Reading, flying nearly 50 naut. miles, instead of the 36 direct.

There can be no argument as to the desirability of all light aircraft having radio, which the new regulations will do much to hasten, but for low-cost equipment to be sufficient, the number of channels in use among various airfields must be drastically reduced. It ought to be possible to fly round an area the size of the U.K. using radio to contact airfields and air traffic control centres on no more than, say, five VHF channels.

London Airport must clearly have a control zone, but even the revised razor-blade-shaped area is far too large. A contraction of only 3 naut. miles on the north, south and west boundaries, would bring all three club airfields now affected clear of the zone; and it would still leave controlled airspace around Heathrow of well over 5-n.m. radius. If this latter figure is adequate for the major American airports with many more movements, it should be sufficient for London.

The size of control zones is governed, in general terms, by the height requirements of large transport aircraft during take-off and landing, taking into account emergency procedures likely to be encountered. Outside the 5-n.m. control zones in the U.S., there is free air space at a minimum height of 1,200 ft., rising to rather higher altitudes in most localities. In other words, provided you are not within five miles of an airfield and are no higher than 1,200 ft., wherever you are, you can guarantee not to encounter, to your mutual embarrassment, a Boeing 707 or something similar on the approach or climb-out.

One gathers that the 5-n.m. figure resulted from an extreme minimum climb case of something like a DC-6B taking-off on a hot day with a 30-knot tailwind down the runway, and it also caters for such emergencies as complete radio failure. Once again, the question may be asked, if this is good enough for the F.A.A., why should it not be acceptable to the M.o.A.? It should equally be possible in the U.K. to guarantee free airspace everywhere outside justified control zones below, say, 2,000 ft.

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From Atlantic Aviation, European distributors for the Grumman Gulfstream, comes the news that the range of this turboprop executive type has been increased from a maximum of 2,400 st. miles to 3,100 st. miles, against a 50-knot headwind, with reserves. This increase may be obtained by the addition of auxiliary fuel tanks to the standard aircraft, when particularly long-range operations are contemplated.

The first Gulfstream demonstrator is due here later this month, and will be shown to interested organizations before departing on a tour of Germany, and then the Middle East.

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To mark the arrangements made for Customs facilities at Berck Airport from Apr. 1, an invitation "reassemblement" is being held over that week-end. This get-together, at very moderate charges, is for sporting and touring pilots and their passengers. There will be the customary time of arrival and similar competitions, refreshment on the aerodrome and a dinner arranged for the Saturday night.

Berck lies just outside the Le Touquet control zone, and its club operates radio on 123.5 Mc/s. Organization of the rally in Britain is being undertaken by Harold Best-Devereux.

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Phoenix Aircraft reports encouraging progress with its home-built Luton Minor and Major designs, which are being constructed by amateurs in such far-flung places as the West Indies, Cyprus, Tanganyika, Canada, Australia, New Zealand, the U.S. and Britain. Last year, Phoenix purchased the entire stock of 36 b.h.p. J.A.P. engines and spares from the Popular Flying Association, and has disposed of all except one of these powerplants, for Luton Minor installation. The company is now compiling a revised handbook for the engine, together with a list of spares held.

CLEAN KLEMM.—The attractive three-seat Bolkow-Klemm Kl 107C is being developed as a four-seater, and a demonstrator is expected in Britain soon, handled by Flair-Aviation.

Both the Luton Minor and Major have been redesigned and restressed for more powerful engines, the Minor up to 55 b.h.p. and a gross weight of 750 lb., and the Major up to 82 b.h.p. and 1,100 lb. Both now conform to current B.C.A.R.s, and some Minors are already being fitted with the 55 b.h.p. Lycoming, without the need for a throttle stop to limit power. Two Luton Majors are being built by R.A.F. enthusiasts at Waddington, the normal powerplant being the 60 b.h.p. Walter Mikron.

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Shaw Aviation Division of Westgate, Yorkshire, the British distributors for the Aeromere Falco, are having made for them a new demonstrator fitted with a 160 b.h.p. Lycoming instead of the 150 b.h.p. powerplant usually fitted. The extra 10 b.h.p. extracted from the Lycoming should give this Italian two-seater a still more sparkling performance than its current 175 m.p.h. cruising speed.

• • •

Substantial orders for Sperry A.L.30 lightweight Gyropilots for the Piaggio P.166 can be expected following the recent successful certification of the autopilot/aircraft combination. This was effected in a production aircraft, which has been delivered to the Consolidated Zinc Corporation of Australia. Another A.L.30 will shortly be installed in Britain in a P.166 belonging to the United Steel Corporation of Sheffield.

• • •

Piaggio are now able to offer the A.L.30 Gyropilot as a standard optional extra to all their customers at a realistic all-in price. The Italian company is considering so equipping its own demonstration aircraft, following the favourable report on the equipment by Commandante Pierotti, Piaggio's chief test pilot. Sperry A.L.30 Gyropilots have been specified for the military version of the P.166 for the Italian Air Force, from whom a large order is expected.

• • •

Under a recent new regulation, all light aircraft flying over Australian capital cities must be equipped with radio. This regulation confirms an existing condition whereby the pilots of non-radio equipped aircraft must obtain telephonic clearance before flying to major airports in Australia.

The Australian Civil Aviation Department plans ultimately to have all aircraft equipped with radio. Although the new regulation applies at the moment only to city areas, by the beginning of 1963 all aircraft in controlled zones, country or city, will have to carry radio.

• • •

The wider application of turboprop power to the Beech range of light and executive aircraft is likely to follow an agreement between Beechcraft and Société Française D'Entretien et de Réparation de Matériel Aéronautique (SFERMA). The agreement puts on a formal basis Beech and SFERMA collaboration on projects in which both companies are currently active. They include other projects of mutual interest which might be undertaken.

Separate articles were also signed for the continuing development of turboprop power for various Beechcraft models, including an ultimate objective of introducing and marketing production propeller-turbine aircraft at some future date. The agreement also authorizes a possible exchange of manufacturing licences by the two companies.

Gliding Notes

by Dr. A. E. Slater

ALMOST the only newspapers which did not describe Sgt. Leslie Manley's landing on a lonely moor as a "crash," after he had returned to civilization next day, were a few local papers which gave his own factual account. He was taking part in the R.A.F. Wave Project in the region around Carlisle, and was flying in a strengthening SSW. wind in the lee of the northern end of the Pennines.

After a take-off from Crosby, he had been flying for nearly two hours when the upcurrents suddenly disappeared and he came down to a normal landing near a farmhouse. But the house was derelict.

He put some stones on the glider and set off along a westerly track which suddenly ended after five miles; so he walked back and tried an easterly track, but with the same result. Then he tried a southerly track, but still no sign of civilization when it got dark, so he returned to the derelict house and slept among hay in the barn.

Next morning, Manley set off southwards again and at 14.30 reached a farm, pretty exhausted. So the farmer, Mr. Lough, walked five miles to Mr. Armstrong's farm and the latter, in turn, walked five miles to Mr. Davidson's farm, where at last there was a telephone and a rescue team could be told where to go and what had happened.

* * *

LATEST news from the R.A.F. Wave Project at Carlisle is that on Feb. 13, Gp. Capt. N. W. "Paddy" Kearon reached 15,400 ft. from a tow to 3,400 ft., and broke off the climb, while still going up at 6 ft./sec., only because darkness was approaching. Yet there was a lenticular cloud overhead at 30,000 ft. At a lower level there was a layer of wave clouds with tops at 5,500 ft.; and at about 7,000 ft., on the way up, Kearon was soaring in company with Flt. Lt. Bacon in an Olympia 419, M/E Eldridge in an Eagle, and Cpl. Jefferey in an Olympia 2b.

To avoid similar frustration in the future, Paddy Kearon is hoping to install goose-neck flares for night landings.

On Feb. 14 the waves appeared again, but at 11.00 hrs. low cloud came in and covered the sky. The wind on both days was blowing from the SW., with the Lake District upwind.

* * *

BOB ROWE, who flew for Australia at last year's World Championships in the Standard Class, won the Australian National Championships held between Dec. 27 and Jan. 8 at Gawler, near Adelaide in South Australia. He scored 995 points out of a possible 1,000 with a Briegleb BG-12, a 50-ft. span machine made of wood, in spite of its being a U.S. design. It is sold in kit form and can be assembled in less than 600 man-hours. With it Bob Rowe went round a 200-km. triangle at 48.9 m.p.h.—an Australian record.

Jack Iggulden came second with 969 points in a Gull 4, and Bert Perrson third with 966 in an Olympia 2. The 56 pilots, sharing 20 sailplanes, covered 14,573 miles across country. The longest distance, 268 miles, was by Rupert Brown in a Skylark 2.

While this was going on in South Australia, Max Howland in Queensland made a goal flight of 201 miles in a Kingfisher with a span of 11 m. (36 ft. 1 in.), and in New South Wales Jack Herford made a 200-mile goal flight in the Joey, of 10 m. span (32 ft. 10 in.), while John Blackwell beat the national distance record with 310 miles. Later, Cliff Gurr set up a national out-and-return record of 230 miles.

A centralized gliding contest is held in Australia every two years. In the intervening years decentralized contests are held simultaneously in different States, with the results combined into a single list for marking purposes; this practice is to be continued only by the casting vote of the chairman at the last annual meeting of the Gliding Federation of Australia. The alternative would have been entirely separate State contests.

* * *

ANNUAL awards for performances in Britain during 1960 have been announced by the British Gliding Association. Plt. Off. Gordon Rondel, with a climb of 29,100 ft. in a cu-nim, gets the de Havilland Cup. A. J. "Rocky" Stone's 222-mile flight from Lasham to Bridgnorth and back counts as an out-and-return for the Volk Cup and a goal flight for the Manio Cup; he had covered the same course the day before but photographed the turning-points without a film in the camera. Peter Scott's 298 miles from the Bristol Club to Scotland earns the Wakefield Trophy.

The California in England Trophy, exclusive to women, goes to Mrs. Anne Burns for a 300-km. triangle. Warrant Off. Ted Stark, Stuart Morrison and Capt. Ted Shephard, whose best flights add up to 575 miles, secure the Douglas Trophy for the Army Club. Col. Tony Deane-Drummond gets the Frank Foster Trophy for 44.3 m.p.h. round a 300-km. triangle, and Humphry Dimock, R.N.V.R. (retd.), the Seager Cup for climbing 13,500 ft. in an Eagle with his son, whose sudden sickness caused the climb to be broken off.

Mrs. Anne Burns who was awarded the California in England Trophy.

Dimock had, in fact, reached 16,500 ft. a.s.l., still climbing fast, when this happened, and as 5,000 m. is only 16,404 ft., it was touch and go whether he could have claimed the first British two-seater record for absolute altitude, which has now been claimed by Flt. Lt. Bacon and M/E Eldridge for their 20,100 ft. in an Eagle near Carlisle on Feb. 14. They were, subject to official confirmation, the first to set up a British gliding record for absolute altitude in the multi-seater class by exceeding 5,000 m.

Taking off by aero-tow from Crosby on Eden airfield, they released at 4,600 ft. and climbed a further 15,500 ft. in a standing wave. But this did not beat by the required 3% the present British two-seater gain-of-height record of 15,240 ft. set up by Flt. Lt. A. D. Piggott and Cadet Flt. Sgt. A. Whatley from Camphill in 1953.

While the Eagle was climbing, a cloud layer closed in beneath, so the pilots glided off eastwards to reach lower ground and landed at Woolsington airfield near Newcastle upon Tyne. There was a light to moderate wind from the S.W. blowing from Skiddaw.

* * *

PILOTS who wonder why they get electric shocks in thunderstorms may not have to wonder much longer. Meteorologists still continue to produce a new theory every few years, each one more plausible than the last, and the latest and most plausible was introduced at the Royal Society on Feb. 9 by Dr. B. J. Mason and Mr. J. Latham of Imperial College.

The interval between the first radar echo from a thunderstorm "cell" to the first lightning flash is only about 20 min., and during that time enough electricity has to be generated within 12 cubic miles of cloud. Previously suggested mechanisms, they say, couldn't do it in the time.

Mason and Latham demand that a hailstone must first hit a supercooled water drop. This causes a thin shell of ice to form round the drop; the heat of solidification warms it; protons migrate into the shell from the interior of the drop (because they can wander more freely in warmer ice) and give it a positive charge. This has to happen in a hundredth of a second, because in another fraction of a second the interior of the waterdrop freezes too, and, for the same reason that waterpipes burst, the ice shell of the drop splits into about a dozen tiny fragments, which are then lifted in upcurrents to the top of the cloud, bearing their positive charge.

The rest of the drop, with its negative charge due to loss of protons, has a greater rate of sink relatively to the air. Thus the negatively and positively charged particles separate; and the same happens to millions of other drops.

And that, until someone caps it with a better theory, is why Mrs. Anne Burns passed out while doing steeply banked circles in the narrow core of lift in her South African thunderstorm, though it does not explain why the Skylark had levelled itself up by the time she "came to." This was at 34,500 ft., and before it happened she had flown through "a lot of soft hail" and experienced electric shocks from the rudder bars and the radio.

Industry Record

Shell Scores Again

Many awards have deservedly been won by the Shell Film Unit's three films on high-speed flight—"Approaching the Speed of Sound," "Transonic Flight" and "Beyond the Speed of Sound." Based on these, Shell has now produced a single 21-minute film which presents in an abbreviated form most of the information and demonstrations in the earlier films. Called "High Speed Flight" (simplified version), it assumes no aeronautical knowledge beyond the meaning of the terms lift and drag.

There is likely to be a large demand for this excellent film, which combines the superb air-to-air colour photography of the earlier films with their outstanding explanations of aerodynamic happenings. These are both simple and technically accurate, a combination which can only be achieved by an immense amount of hard work and research behind the scenes.

The simplified version of "High Speed Flight" is available on loan free of charge from the Petroleum Films Bureau, 29 New Bond Street, London, W.1. Both 16-mm. and 35-mm. Eastman Colour prints are available.

Lighting for Yugoslavia

More airport lighting equipment with an estimated value of £30,000 has been ordered from the General Electric Co., by Yugoslavia. Total value of the contracts placed with G.E.C. is now more than £100,000. The latest order, for a complete airfield lighting installation at an undisclosed airport, calls for high-intensity runway and approach lights, taxiway lights, transformers, constant current regulators and switch and control gear.

Swedish Air Defence

Marconi's Wireless Telegraph Co., Ltd., has received a further order from the Royal Swedish Air Board for electronic equipment for use in the country's air defence system valued at £1,700,000. The first order, placed in 1959, was for similar equipment and worth £1,500,000.

The Marconi system is based on a high-speed computer which solves a large number of interception problems simultaneously and enables defence weapons such as fighters and guided missiles to be brought into action at exactly the right moment. Black and white television and colour projection together with automatic information dissemination techniques also play a vital part in the overall system.

Gone from Gatwick

Gatwick House, Horley, Surrey, is the new address of Aerocontacts, Ltd., and its associated companies who have left Gatwick Airport after 14 years. The move is a short one however for the new offices are just two miles from the airport. Horley 4455 is now the company's telephone number and the cable address of "Aerocon Horley" is unchanged.

Heating Tape Advancement

A new type of electrical heating tape is now being marketed by M.E.I. Co., Ltd., of Wolverhampton. Known as Hotfoil, it is a flat element heating tape which may be wrapped around any pipe, valve or vessel to heat it or attached to a surface to radiate warmth. Advantages claimed for it over existing heating tapes which have round wire elements woven into, or encased in, textile coverings are an improved heat flow and effective heating at a lower tape temperature.

Hotfoil is a 1-in. wide tape containing six flat elements of thin metal foil individually and collectively insulated with a high temperature polyester plastic material. Threequarters of the width is heating surface.

Plastic Ducting Development

Extreme lightness and ability to re-form to contour after crushing are two features of a new glass-reinforced plastic ducting introduced by Baxter, Woodhouse and Taylor, Ltd., which has been designed to solve a particular problem in the aircraft industry.

The original problem was to pass a 2-in.-dia. duct with a right-angle bend and a ½-in. flange on either side through a 2-in.-dia. hole in a bulkhead panel to connect two main air ducts. Misalignment had to be allowed for and this was done by including a built-in nylon corrugation. No existing type of ducting was satisfactory and after a series of tests a specially developed resin compound was evolved which, when reinforced with Forthergill and Harvey's Tyglass cloth, provided a ducting capable of being crushed allowing the flange to pass through the bulkhead panel hole.

Advantages claimed for the ducting include good air flow, non-corrosive, resistance to heat and chemicals and durability. In addition brittleness has now been overcome, a fault of previous types of glass-reinforced plastic ducting.

After crushing, the glass-reinforced plastic ducting produced by Baxter, Woodhouse and Taylor, Ltd., easily re-forms to its original shape.

Biggin Hill Service

An A.R.B. and A.I.D. approved overhaul and repair workshop for test equipment has been opened at Biggin Hill by A. J. Whittemore (Aeradio), Ltd. Repair, overhaul and certification of such varied items as beat frequency oscillators, valve voltmeters, oscilloscopes, absorption wave meters and output meters, heterodyne frequency meters, and signal generators from 100 c/s. to 1,000 Mc/s., to within an accuracy of 0·001%, can now be undertaken by the company.

Starting by Steam

An approximate cost of 1s. 6d. per start is claimed for a steam generating system for gas turbine starting developed as a private venture by Associated Electrical Industries, Ltd. It has been produced with a view to use with the Bristol Siddeley Olympus and Orpheus engines, but lends itself to starting civil gas-turbine engines economically.

The complete equipment is mounted on a Land-Rover which carries sufficient fuel for 50 starts. Steam generated in the flash evaporator is at similar temperature and pressure conditions to those used at present in low-pressure air starting systems. Existing air starter turbines and hoses can be used.

The Land-Rover engine drives the water pump for the flash evaporator together with the fuel pumps and air blower for the single combustion chamber. This burns wide-cut aviation fuel to provide heat to evaporate the water.

When engine starting is under the control of a ground operator it is unnecessary to take power from the aircraft electrical system. When it is under the control of the pilot only the power required by valves in the aircraft is demanded.

The system output can be adjusted to suit different engine requirements. A typical starting time is approximately 15 secs.

A.E.I.'s steam generating starting unit mounted on a Land-Rover.

Correspondence

Spin and Spin Recovery

I WAS discussing this subject with Leslie Tait Cox just before he died last year.

He was at R.A.E. Farnborough from 1915 onwards and he claims that the recovery from a spin was worked out aerodynamically by Prof. Lindemann.

After a time he got a pilot to carry out his theory, centralize controls and apply slight opposite rudder. I think he must have been a brave man because he tried it out on none other than a F.E.8 pusher.

He started at 4,000 ft. and was successful. Date 1917. I was in Canada in 1917 with No. 1 School of Aerial Fighting flying Curtiss Buffalos and J.N.4As. We had many fatal crashes caused by spinning in.

I well remember the day when four instructors came from England who demonstrated this with all the cadets and instructors lining the tarmac.

Pinkneys Green, Maidenhead. R. G. JACKSON.
(Late R.F.C. and R.A.F.)

Independent Airlines

I OFTEN wonder, when the airlines of the World started requiring international air routes, if the shipping companies, especially those in Britain, objected on the grounds that they were losing considerable passenger and freight traffic to these airline companies.

I have a feeling that this opportunity never existed and therefore, especially now that some reputable shipping companies have bought interests in British independent airline companies, thereby giving them the financial resources for expansion without being a burden on the British taxpayer, surely, they have now as much right as the Government-controlled corporations to have a slice of the ever-increasing World air traffic which would at any rate create a healthy and desirable competition.

Take for instance Cunard Eagle Airways, Ltd. Most travellers must know the excellent services the Cunard Steamship Co. are giving their sea-going passengers and no doubt they had every intention to continue these services in aviation when they amalgamated with the formerly known Eagle Airways, a company with a high reputation as a safe and progressive airline. This combination can give the air-minded traveller everything he requires. The same applies to the British United Airways who also have several important shipping interests in their company.

It was refreshing to note that the official body of the British Airline Pilots Association have given their blessing to these companies which have applied to operate regular air services side by side with B.E.A. and B.O.A.C. I only hope that the above-mentioned independent companies will find a workable solution whereby it is not necessary to fight each other; and we can only hope that the Air Transport Licensing Board will allow these progressive companies to operate in harmony with the present corporations, for the benefit of the ever-increasing air passengers.

I further hope that more and more official bodies and prominent people in British aviation will voice their favourable opinions because the British independent airlines deserve to be given every possible encouragement.

Maidenhead. H. J. HOLLEMAN.

Passenger Safety in Aircraft

THE current controversy over the relative hazards of using JP.4 (aviation turbine gasoline) or JP.1 (kerosene) as fuel for turbine-engined and jet aircraft is as yet unresolved. However, both protagonists are agreed that the overriding factor from all points of view is maximum passenger safety.

By their very nature all fuels are dangerous when not contained, and in this respect it is interesting to note that the Recommendations Appendix to Chapter D5-2 of British Civil Airworthiness Requirements Section D states: "When possible fuel tanks should not be located within the fuselage or the centre section of a wing passing through the fuselage." Also: "Where tanks must be installed in locations likely to be distorted inboard of, or adjacent to, the outboard engine, robust bag-type tanks protected against local damage are recommended."

It could well be that the torsion box integral fuel tank of shear web/integrally machined skin-stringer panel construction is not so "likely to be distorted," but the fact remains that bag-type tanks do have a greater margin of safety at crash case and emergency landing case inertias. This fact is well illustrated by an analysis of results of accidents to aircraft fitted with even lightweight bag tanks.

Turbine aircraft of relatively high wing loading have large fuel capacity demands, and the fitting of bag-type tanks will reduce the capacity compared with integral tanks. Also, bag tanks incur a weight penalty with a consequent reduction in payload. However, their use considerably simplifies the surrounding structure and in the event of local damage to a bag tank it can be quickly and easily repaired or replaced. The weight penalty incurred would represent only a marginal

Wroundabout

Oil Folks at Home. Colin Cooper, helicopter salesman, seems never to write from the same place twice —U.S.A., Paris, U.K., West Indies—and now he sends a note from a place in the Alpes Maritimes with the vaguely apt cable address of "Helicopters Opio." Just to tell me that three commercial S.62s (20-passenger amphibians) have been sold, the latest to a wealthy Texan who is so proud of it he only flies it in his drawing room.

*

Mess Games. The R.A.F. are never slow to introduce mechanical devices into their indoor pastimes as well as their aviating. Bicycles have long been good value, of course, and now it is no surprise to see a trampoline or some hobby-horses brought on after dinner. The trampoline, modified for speedy assembly and removal, has produced its masters who, jacketless and in stockinged feet, can reach the heights of the ante-room ceiling. The hobby-horse has three legs, all pivoting fore and aft. Skilled practitioners can get their C.G. nicely poised over the centrally placed rear leg, swing the forelegs forward with their feet, then bring up the rear leg and so race against one another. The less gifted (guess who) cannot even sit on the treacherous beast without toppling over its head or tail.

*

"They've made more money from the mods. than from the aircraft."

*

Changing Face. When the first aircraft landed at mountainous Gilgit in Pakistan, the natives are said to have asked what time of the year it mated and how many eggs it subsequently laid. Now Pakistan Airways have flown the dicey route through the mountains into Gilgit and Skardu from Rawalpindi for 10 years without a mishap and the same people, who have obviously taken to reading this magazine, are demanding that the DC-3s be replaced by turbine-powered aircraft. I hear that for a start they're getting a Fokker Freightship. To bring in their TV sets and Hi-Fi record players, I suppose.

*

On and Off Course. Overseas students at the Empire Test Pilots' School have their problems. There was the Indian Air Force student who said: "This place should be called the Empire Languages School —it's all Greek to me." And the U.S.N. student (not quite with it on U.K. geography) who said: "I reckoned I had been going west so long I must be over the Yorkshire moors."

*

"Pssst! Sensational Atlantic air freight breakthrough, guv — very swift, very cheap!"

by Wren

Correspondence . . . .

increase in cost per passenger mile which is out of all proportion to the increase in safety which would be achieved.

The general introduction of bag tanks—particularly in the danger areas inboard of the outboard engines—is long overdue and would allow airline operators to choose either JP.4, kerosene or any other fuel based on their relative technical and economic merits. These facts should be brought to the notice of the public who rightly expect to travel as airline passengers with maximum possible safety.

Woking, Surrey. H. G. MUFF.

No Duplication of Space Effort

SIR ROBERT RENWICK is reported by you to have given the following as one of the "principal objectives" of the British Space Development Company:

"To provide the greatest economy in the use of the limited number of technical personnel available in this country, particularly in the field of astro-physics and astronautical engineering, and to ensure that duplication of effort, which has been so prevalent in the U.S.A., and which has contributed to wasteful use of resources, is avoided in the U.K."

The selection of the term "duplication" by Sir Robert bears examination. If he knows of a single example of an astronautics project that was duplicated in the United States, it would be interesting to hear from him on the subject. The familiar technique of financing *two different solutions to the same problem* is, of course, quite another matter. With advanced technological systems, especially in the early stages, such an approach does give the agency placing contracts the chance to sift the gold from the gilt, and this cannot be done at the brochure stage as often as one might wish.

The dogmatic assertion that the United States has wasted some of its resources in mounting its astronautical programme is often made in private, but rarely in public. Sir Robert is presumably able to justify this assertion. One way of doing this might be to go back in time—say to 1945—and show how things should have been done differently *without the benefit of hindsight*.

Weston-super-Mare, Somerset. S. W. GREENWOOD.

C.O.s—Past and Present

Your information on the Congo
Is somewhat out of date and wrong-o,
So now's our chance to put you straight,
Although it is full eight months late,
For Squadron 36 you know
Is commanded by the chap below.
No doubt you'll put the record right,
But keep this rhyme from public sight!

No. 36 Squadron, L. F. WOLSEY (Wg. Cdr.).
R.A.F. Colerne, Wilts.

[Despite the plea in the last line we have obtained Wg. Cdr. Wolsey's permission to publish his little rhyme. The name given in the article concerned (Feb. 17, p. 170) was obtained from the Information Division of the Air Ministry.—ED.]

Let's Get This Straight

IN a recent book on the Spitfire the old false claim is made that the Supermarine S.4 set up a World Speed Record of 226.9 m.p.h. previously held by a Curtiss Racer. But the absolute World speed record had been set up at 278.5 m.p.h. by the Frenchman Bonnet in a Bernard in 1924.

The claim that the S.4 set up this new World speed record has been made several times down the years by both Vickers and Napier, and I have given the true facts several times. The S.4 record of 1925 was a British record and a World *Seaplane* Record—but not a World Speed Record. Once these false claims are in print they get an aura of truth around them which later historians take for gospel. What a pity this Spitfire book didn't get it right, for now the false claim will be given new life.

London, W.14. GEOFFREY DORMAN.

Publication Received

Axial Flow Fans, by R. A. Wallis. A handbook on the aerodynamics of axial flow fans, analysing the results of aerodynamic research and presenting them in a usable manner for those concerned with fan design and application. 368 pp., 5½ in. by 8½ in., illustrated. George Newnes, Ltd. 50s.

Aviation Calendar

Mar. 3

London.—R.Ae.S. Rotorcraft Section lecture, "Helicopter Approach Aids," by H. W. Mitchell and S. G. Lennox, in the Lecture Theatre, 4 Hamilton Place, W.1, at 19.00 hrs.

Mar. 4

London.—B.I.S. lecture, "Possible and Impossible Alternatives to the Chemical Rocket," by D. S. Carton, in the Tudor Room, Caxton Hall, S.W.1, at 18.00 hrs.

London.—Science Museum lecture, "The Story of Flight," at The Science Museum, Exhibition Road, S.W.7, at 15.15 hrs.

Mar. 6

Coventry.—Lanchester College of Technology, Rocket Engine Technology lecture, "Scientific Value of Space Exploration and Present Achievements," by H. G. R. Robinson, at the College, at 19.00 hrs.

Mar. 7

London.—R.Ae.S. Astronautics and Guided Flight Section lecture, "Guided Weapon Control Equipment," by John Dent in the Lecture Theatre, 4 Hamilton Place, W.1, at 18.00 hrs.

Mar. 8

Chester.—R.Ae.S. Branch main lecture, "Some Low Speed Problems of High Speed Aircraft," by A. Spence and D. Lean, in the Lecture Theatre, Grosvenor Museum, at 19.30 hrs.

London.—Kronfeld Club, Photographic Exhibition and talk by F. N. Slingsby in the Basement, 74 Eccleston Square, S.W.1.

Southend.—R.Ae.S. Branch lecture, "Navigational Aids," in Room 3, Engineering Dept., Municipal College, London Road, at 19.30 hrs.

Weybridge.—R.Ae.S. Branch lecture, "Protection of Aircraft Against Fire and Explosion Hazards," by J. R. Stevens, in the Apprentice Training School, Vickers-Armstrongs (Aircraft), Ltd., at 18.00 hrs.

Mar. 9

London.—Radar and Electronics Association lecture, "Air Traffic Control," by Arnold Field, at the Royal Society of Arts, John Adam Street, W.C.2, at 19.30 hrs.

Mar. 10

Feltham.—R.Ae.S. L.A.P. Branch Third Sir Richard Fairey Memorial lecture, "Sailing," by Uffa Fox, at the Feltham Hotel, at 18.30 hrs., followed by Branch dinner, at 20.00 hrs.

London.—British Gliding Association Annual Ball, at Londonderry House, 19 Park Lane, W.1, at 20.30 hrs.

Company Notices

NEW COMPANIES

BRITISH ASSOCIATION OF HELICOPTER OPERATORS, LTD. (682,865).—Reg. Feb. 8 as a company limited by guarantee without share capital. Original number of members is 50 each being liable for £5 in the event of winding up. Subscribers are:— W. J. Riddy, Salveson and Co., Leith, Edinburgh (general manager); T. M. Clutterbuck, Micklefield Hall, Rickmansworth, Herts (director, Helicopter Services, Ltd.); J. E. Harper (director, Fison-Airwork, Ltd.); W. H. Armstrong (director, Autair, Ltd.); John W. Pooley (general manager, Executair, Ltd.); Arni L. Sumarlidason (director, Bahamas Helicopters U.K., Ltd.); R. H. Murray-Philipson (director, Executive Helicopters), Ltd. The management is vested in a council, the first members of which are not named. Sols.: Hugh V. Harraway and Son, 2 Field Court, Grays Inn, W.C.1.

J.C.B. (RESEARCH), LTD. (682,651).—Private co. Registered Feb. 6. Capital £100 in £1 shs. To undertake research and other scientific work in connection with the marine, motor, aircraft, hydraulic and agricultural engineering trades or industries. Directors: Joseph C. Bamford (permanent director and chairman) and Marjorie Bamford, both of Roycroft Lodge, Bramshall Road, Uttoxeter, Staffs. Sec.: J. Blairs. Sols.: Ansell and Sherwin, Birmingham, 2. Reg. off.: Lakeside Works, Rocester, Uttoxeter, Staffs.

LIGHTPLANE MAINTENANCE SERVICES, LTD. (683,003).—Private co. Reg. Feb. 9. Cap. £100 in £1 shs. Directors: Ernest E. Chick and Mrs. Ishbel Chick, both of 20 Beech Drive, Borehamwood, Herts. Sec.: H. W. Wainwright. Reg. off.: Elstree Aerodrome, Elstree, Herts.

INCREASE OF CAPITAL

Falcon Airways, Ltd. (616,038), Waterloo Chambers, Fir Vale Road, Bournemouth.—Increased on Jly. 6, 1960, by £75,000 in £1 ordinary shs. beyond the reg. cap. of £25,000.

CHANGE OF NAME

Aerofilms, Ltd. (344,913), 4 Albemarle Street, W.1.—Name changed to Aerofilms and Aero Pictorial, Ltd., on Jly. 5, 1960.

New Patents

APPLICATIONS ACCEPTED

865,009.—**Curtiss-Wright Corporation.**—"Apparatus for simulating the operating characteristics of turbojet aircraft engines."—May 7, 1957. (May 15, 1956.)

865,205.—**Ministry of Supply.**—"Aircraft altitude indicator and like apparatus."—Dec. 30, 1955. (Dec. 31, 1954.) Divided out of 865,344.)

865,078.—**Etudes et Fabrications Aéronautiques.**—"Parachute container."—Feb. 26, 1959.

Printed specifications of the above will be available on Apr. 12, 1961, and the opposition period will expire on Jly. 12, 1961.

Personal Notices

BIRTHS

Allen.—On Feb. 16, at R.A.F. Leuchars, to Monica (*née* Hadlington), wife of Flg. Off. E. Allen—a daughter.

Clarke.—On Feb. 15, at R.A.F. Hospital, Ely, to Ruth, wife of Flt. Lt. D. B. Clarke—a daughter.

Farren.—On Feb. 16, to Kath, wife of Flt. Lt. R. Farren—a son.

Hunter.—On Feb. 11, to Sheila, wife of Flt. Lt. K. Hunter—a daughter.

Mandeville.—On Feb. 12 at the Louise Margaret Hospital, Aldershot, to Phyllis, wife of Sqn. Ldr. F. Mandeville—a daughter.

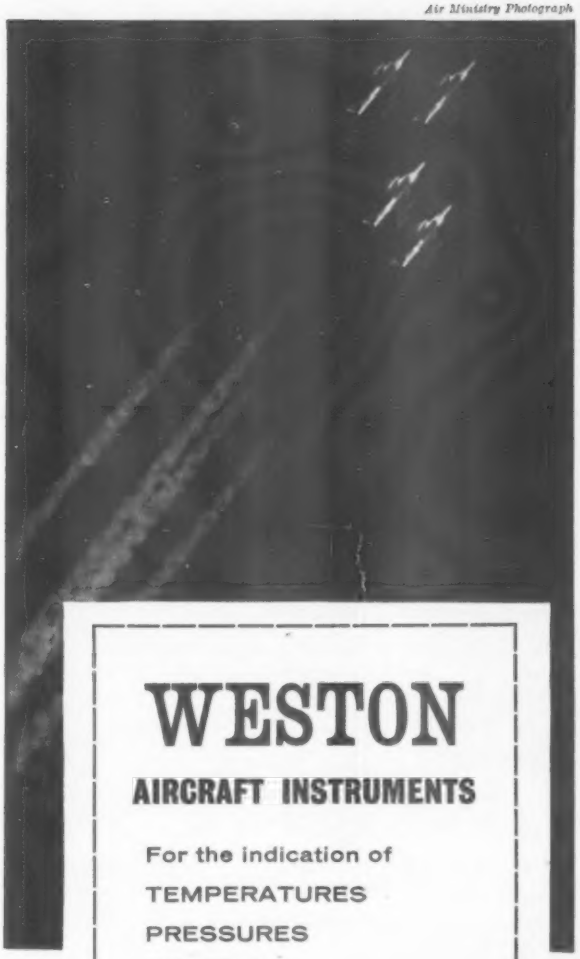
Sugden.—On Feb. 13, at R.A.F. Hospital, Cosford, to Freda Winifred, wife of Sqn. Ldr. G. P. Sugden—a daughter.

Wilkes.—On Feb. 13, at R.A.F. Hospital, Wroughton, to Joan, wife of Wg. Cdr. A. H. Wilkes—a daughter.

DEATH

Rankin.—On Feb. 6, Gp. Capt. David Rankin, R.A.F. (retd.).

Air Ministry Photograph



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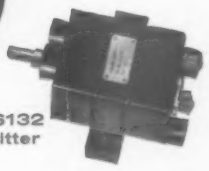

*Model S132 Transmitter

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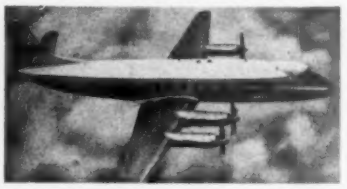

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